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SERVICING MANUAL
for
DATRON MODEL 1045
DIGITAL VOLTMETER

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NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6HQ ENGLAND

MP MASTER
MA23504

SERVICING MANUAL
for
DATRON MODEL 1045
DIGITAL VOLTMETER

(FOR GENERAL INFORMATION
AND SPECIFICATION REFER TO
OPERATING MANUAL)

Instrument Designed and Manufactured by:–

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SECTION 1

TECHNICAL DESCRIPTION

1.1 GENERAL

The internal circuitry of the 1045 DVM comprises two printed circuit boards. The DC Isolator board, which contains the preamplifier, scaling circuits and bootstrapped supplies to produce a nominal 1 volt DC output from any full range input signal. The Analog to Digital Converter board digitizes the analog signal and produces the BCD output together with drive for the display. The regulated power supply components are also mounted on this board.

The boards are described separately, each board being sub-divided into its various functions.

1.1.1 Mechanical Layout

The upper board in the 1045 is the A – D converter with the DC Isolator board located beneath it. Both are fitted with guard shields which enclose the analog circuitry.

1.2 DC ISOLATOR

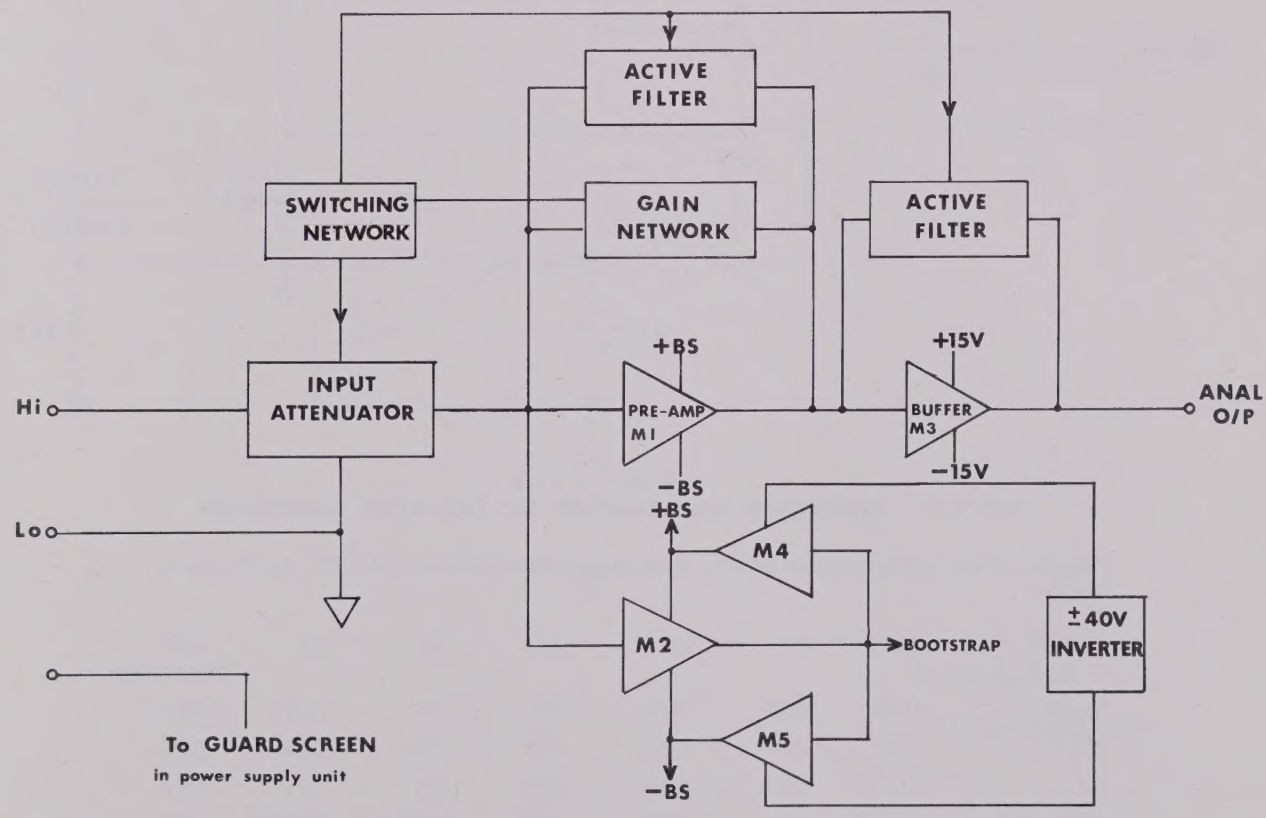


FIG 1.1 SIMPLIFIED DIAGRAM OF DC ISOLATOR

The DC Isolator comprises the following circuits:–

1. Range switching and preamplifier scaling.
2. Bootstrapped supplies.
3. Drift Compensation.
4. Filtering.

1.2.1 Range Switching and Preamplifier Scaling

The simplified diagram, Fig. 1:2, shows the essential features of the isolator scaling circuit. For the purpose of explanation the same symbols are used (Black triangular contact normally 'made', white triangular contact normally 'open') regardless of whether the switching is accomplished electronically (F.E.T.) or by means of switch contacts. In Fig. 1:2 all switching is shown in the 1V RANGE position.

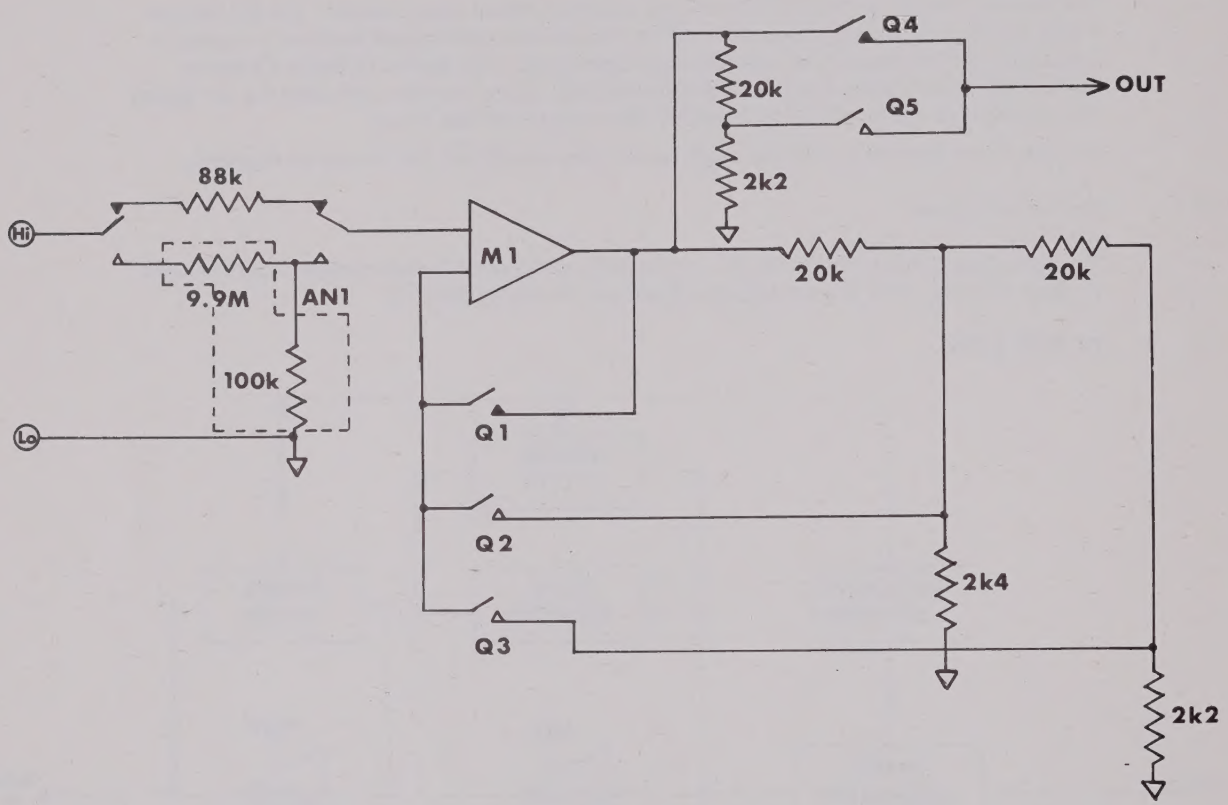


FIG 1.2 SIMPLIFIED DIAGRAM OF DC ISOLATOR SWITCHING

Selection of any particular range drives a diode matrix which switches the F.E.T.'s as shown in Fig. 1:3.

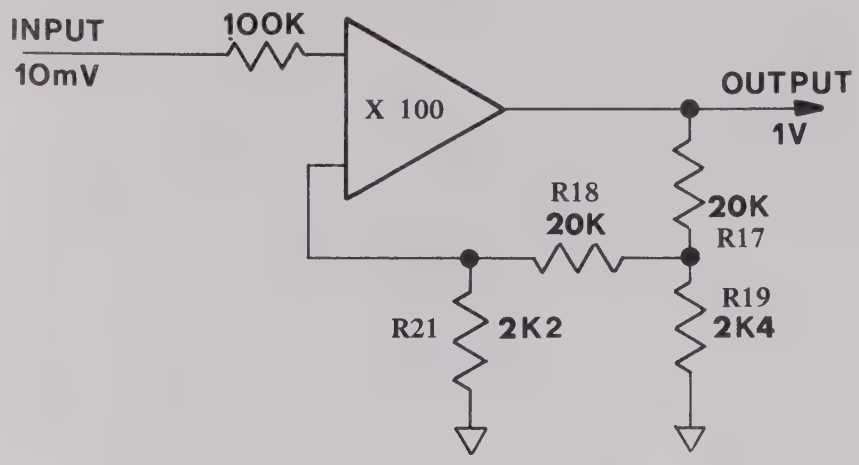
RANGE	GAIN	Q1	Q2	Q3	Q4	Q5	AN1 SELECTED
10mV	X100	OFF	OFF	ON	ON	OFF	OFF
100mV	X10	OFF	ON	OFF	ON	OFF	OFF
1V	X1	ON	OFF	OFF	ON	OFF	OFF
10V	÷10	ON	OFF	OFF	OFF	ON	OFF
100V	÷100	ON	OFF	OFF	ON	OFF	ON
1000V	÷1000	ON	OFF	OFF	OFF	ON	ON

FIG. 1:3 STATES FOR ISOLATOR SWITCHES

The circuit configuration for each separate range is shown in Fig. 1:4.

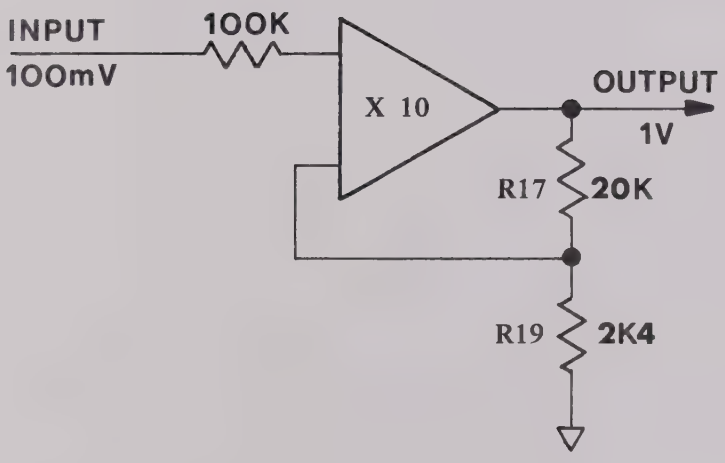
a) 10mV RANGE

VOLTAGE GAIN X100.



b) 100mV RANGE

VOLTAGE GAIN X10.



c) 1V RANGE

VOLTAGE GAIN X1.

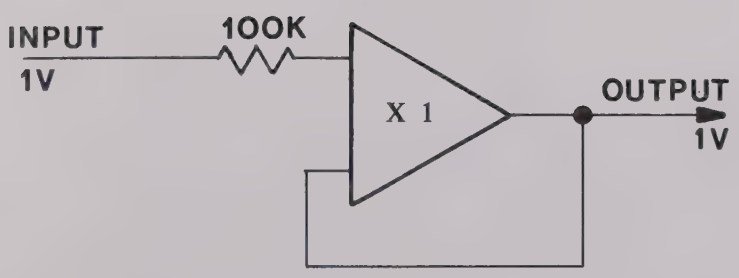
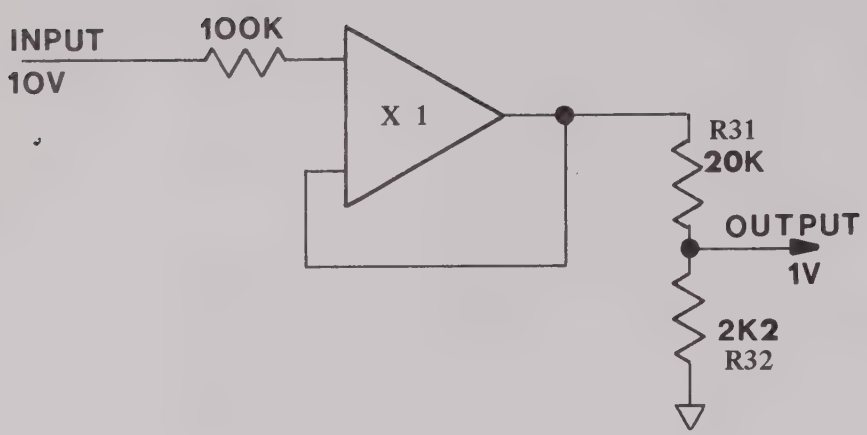


FIG. 1:4 SEPARATE RANGE SWITCHING

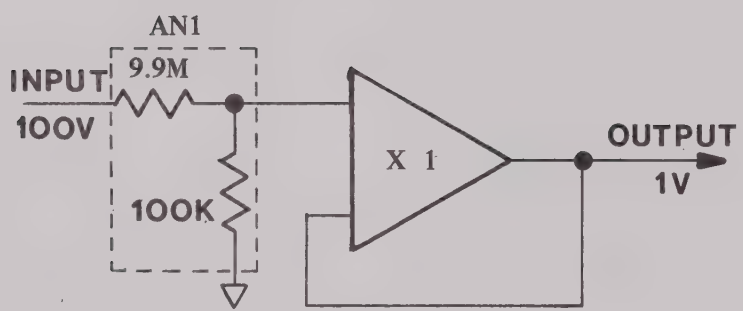
d) 10V RANGE

VOLTAGE GAIN ÷ 10



e) 100V RANGE

VOLTAGE GAIN ÷ 100



f) 1kV RANGE

VOLTAGE GAIN ÷ 1000

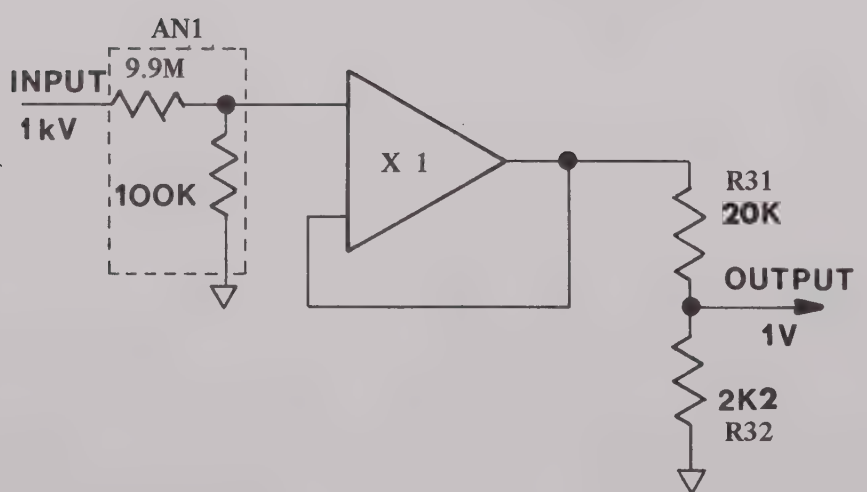


FIG. 1:4 SEPARATE RANGE SWITCHING

The following description refers to the circuit diagram drawings, (430013).

Resistor chain R1 – R4 is in series with the Hi input on all ranges from 10 mV – 10 V. The amplifier end of R4 is clamped by zener diodes D32, D33, Q9 and Q10 to the bootstrap rail, which is in turn clamped to Lo (0) by zener diodes D36 and D37. This means that the amplifier input can never exceed approximately + 35 V: the sum of the zener diode voltage drops. The input resistor chain limits the current in overload. The power dissipation of the chain is such that 1000 V can be applied continuously.

On the 100 V and 1 kV ranges a ÷100, 10 MΩ input attenuator is switched in. This is a matched set of resistors for low temperature coefficient.

On selecting 10 mV, Q3 and Q4 are turned on: all other F.E.T.'s are turned off. The output of M1, the preamplifier, is then connected to its inverting input via R17, R19, R18 and R21, an attenuator chain of ÷ 100, which gives the amplifier an overall gain of x 100. Q4 connects the preamplifier directly to the output buffer M3.

On selecting 100 mV Q2 and Q4 are turned on: all other F.E.T.'s are turned off. M1 output is connected to its inverting input via R17 and R19, a ÷ 10 attenuator. The overall amp gain is X 10. Q4 again connects the preamplifier directly to M3.

With 1 volt selected, Q1 and Q4 are turned on. The preamplifier output is now connected directly to its inverting input giving a gain of unity. For the 10 V range, Q1 is kept on, retaining a preamplifier gain of unity but the output of M1 is attenuated by 10 (R31 – R32) before being passed to the output buffer via Q5.

The 100 V range selects the 1 volt range and inserts a ÷ 100 attenuator (AN1 and R76) between the Hi and the preamplifier input.

The 1 kV range selects the 10 volt range and also inserts the same ÷ 100 attenuator (AN1 and R75) at the front end.

The gain is slightly greater than unity on the 1 volt range because of the shunting effect on the feedback network of the offset voltage injection resistor R14. This effect is compensated for by slight attenuation of R71 between the preamplifier and the output buffer.

1.2.2 Bootstrapped Supplies

The preamplifier is designed to present an input impedance of greater than 10,000 MΩ for signals up to ± 20 V. Bootstrapping (tracking of both common lines and supply voltages with the input signal) is essential for correct operation of input bias compensation, input offset voltage compensation, temperature compensation, F.E.T. switching and common mode rejection.

M2 is a high impedance buffer which looks at the inverting input of M1. The offset of M2 is adjusted so that its input is within 100 μV of the input of M1. M1 thus functions as a low impedance rail following the signal precisely.

By means of zener diode level shifting M4 and M5 produce outputs tracking + 9 V and – 9 V respectively from the bootstrap rail. These rails power the preamplifier M1 and the bootstrap amplifier M2 as well as driving the switching to the F.E.T. gates. For example with + 15 V on the high terminal the +ve supply of M1 is +24 V and the –ve supply +6 V. This produces excellent common mode rejection. A capacitive inverter driven from M6 provides ± 38 V from the ± 15 V rails giving the 30 V stabilized needed for the + BS rail.

The levels of 15 V above and below bootstrap are provided by zener diodes D34, D35. To prevent the voltage rating of M4 and M5 being exceeded the rails are provided with a low output impedance by emitter followers Q12 and Q14.

1.2.3 Drift Compensation

M1 is a device selected by Datron which undergoes a long high temperature 'burn-in' on power. The device exhibits a nominal voltage drift of ± 5μV/°C and a typical bias current of 1 nA. Q11 is kept in close thermal contact with M1 and the whole input stage is under a draught excluding plastic moulding. Q11 has a base emitter voltage which changes at the same rate with temperature as the bias current of M1. Consequently a current derived from Q11 base emitter and fed into M1 input compensates for the bias current. Tracking to ± 2pA/°C is achieved in this way.

To compensate for voltage drift, the actual drift is first measured and a correcting offset then injected to reduce that drift.

The final drift is $< 0.2\mu V/^{o}C$ from 0 to 50°C. For a more complete description see Maintenance (Section 2).

1.2.4 Filtering

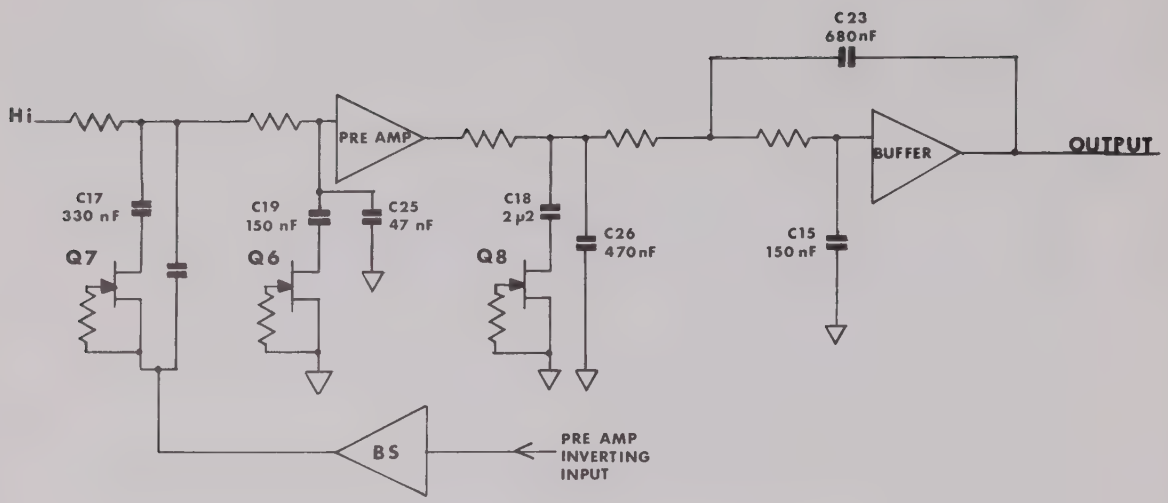


FIG 1.5 FILTER NETWORK

When FILTER is not selected, Q6, Q7 and Q8 are turned off and the filtering comprises C25, C24, C26, C23 and C15. This gives the DC Isolator a response to 0.01% in 80 mS with an attenuation of 20 dB.

When FILTER is selected, Q6, Q7 and Q8 conduct, thus connecting C17, C19 and C18 into circuit. This gives a response to 0.01% in 350 mS with an attenuation of 57 dB.

To reduce the effects of dielectric absorption all capacitors in the front end are polypropylene, the remaining effects being compensated for by Q16, C27, C28, R81, R82 and R83.

1.3 ANALOG TO DIGITAL CONVERSION

Assembly Drawing No. 400027.

Circuit Diagram No. 430004.

1.3.1 Analog Section

1.3.1.1 General

Section 2.2.5 and Fig. 2:2 in the Operating Manual give a very basic description of the principles of dual-slope integration. This section covers in more detail the integration as preformed by the 1045 voltmeter. Fig. 1:6 is a block diagram showing the essentials of the analog section of the A – D Converter. The two-way switches are in fact field effect transistors (F.E.T.'s) switched by diode logic and flip-flop circuits. Fig. 1:6 shows the circuitry in the RESET state, waiting for the SIG pulse.

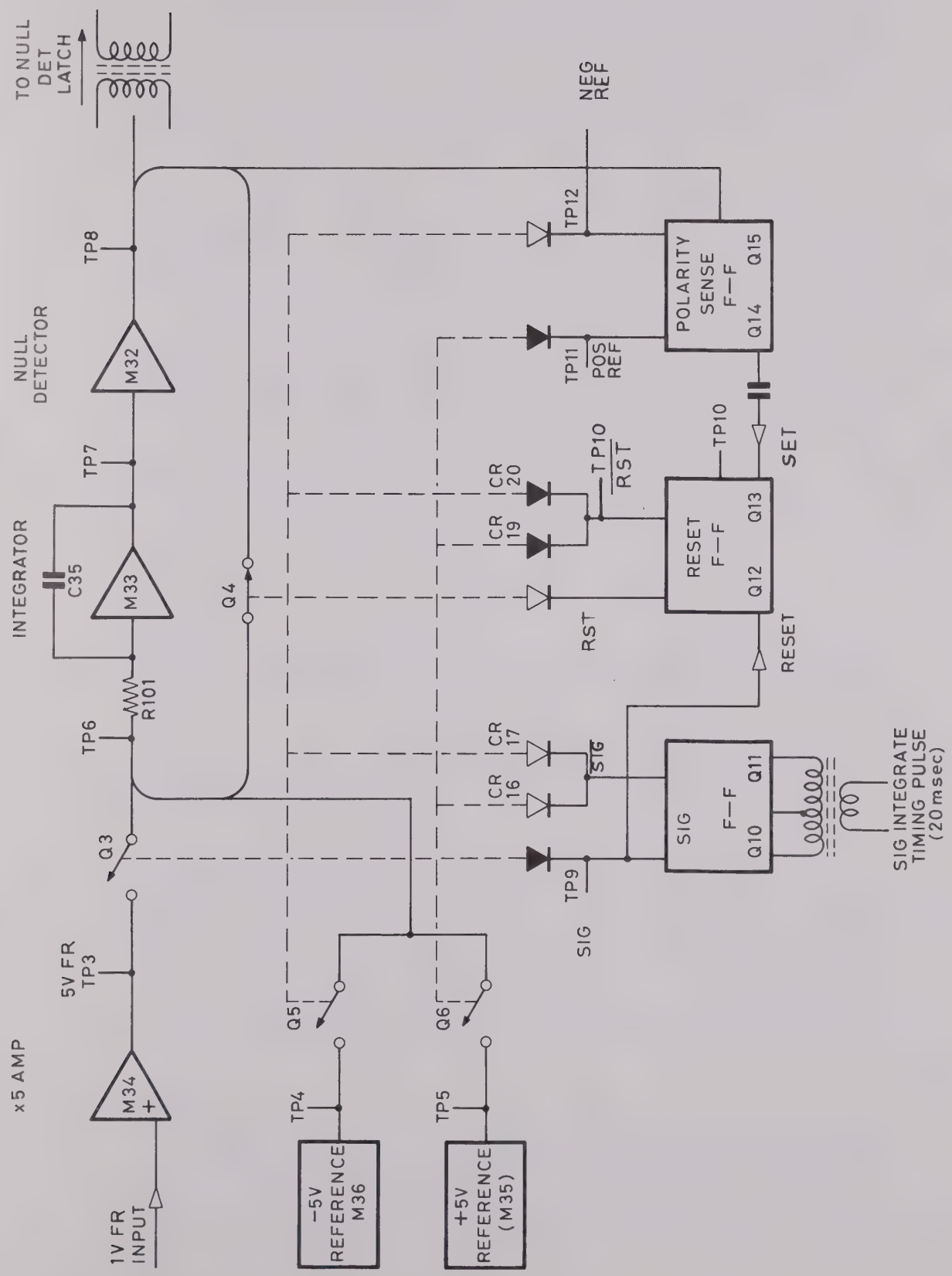


Fig. 1.6 Dual–slope integrator switching

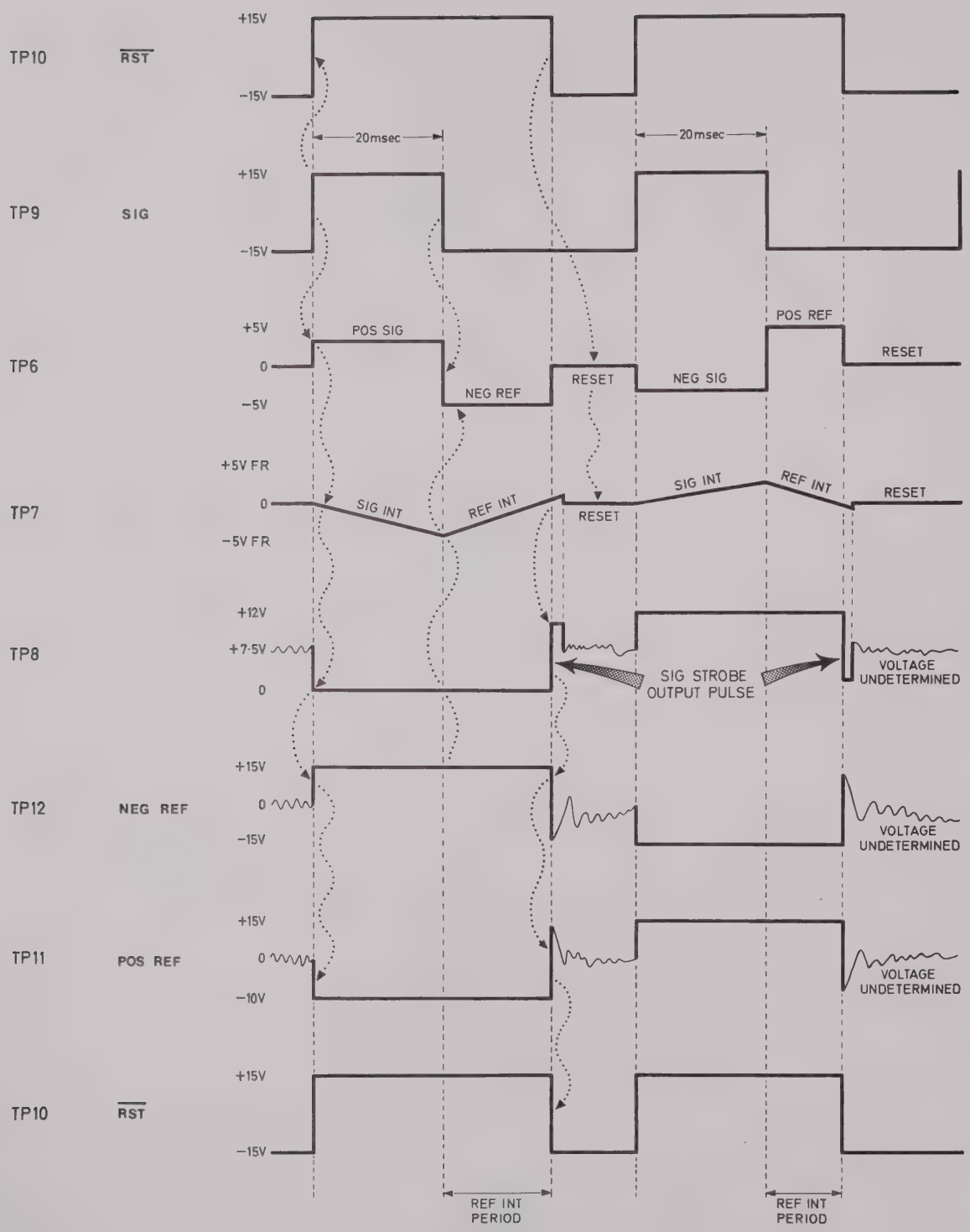


Fig. 1.7 Integrator timing diagram

As explained in Section 2.2.5 of the Operating Manual, the input signal is applied to an integrator for a set period of 20 mS, and the charge acquired by the integration capacitor during that time is proportional to the amplitude of the applied voltage. The capacitor is then discharged to zero volts by connecting the Integrator to a precise reference voltage; the length of time the reference voltage has to be applied in order to reach zero volts is measured by digital circuitry, and is proportional to the amplitude of the input signal.

The sequence of operations detailed in the following paragraphs should be read with reference to the timing diagram Fig. 1:7 and the circuit diagrams. The timing diagram shows first a positive input signal followed by a negative signal of smaller amplitude.

1.3.1.2 Signal Integrate Period

The 1 volt full-range input signal from the DC Isolator board is amplified to 5 volts full-range by M34 and appears at TP3.

A signal integrate period is initiated by the positive-going edge of a timing pulse from the digital part of the circuit via TR2. This signal sets the SIG F/F comprising Q10 and Q11 driving TP9, SIG, to its positive state. This signal switches F.E.T. Q3 on and also resets the RESET F/F. $\overline{\text{SIG}}$ from Q11 being in its negative state inhibits the reference switching lines via diodes D16 and D17.

Q3 being switched on enables the input signal (of some value less than 10 volts) to appear at TP6 and be applied to the virtual earth inverting input of the integrator M33 via R101. If the signal at TP6 is positive then the output of the integrator at TP7 will move off negatively. This voltage is greatly amplified by the Null Detector M32, the output of which is limited by diodes D9 and D10 giving a very fast edge at the output for a small departure from zero input.

The Null Detector output voltage at TP8 sets the POLARITY SENSE F/F which will enable selection of the appropriate 5 V reference during the reference integrate period.

Throughout the Signal Integrate period the integrator capacitor continues charging at a rate proportional to the input voltage.

1.3.1.3 Reference Integrate Period

At the end of the 20 mS timing pulse from the digital section, the SIG F/F is reset. TP9 goes to its negative state turning Q3 off which removes the input signal from the integrator. $\overline{\text{SIG}}$ goes to its positive state switching diodes D16 and D17 allowing either Q5 or Q6 (as determined by the state of the POLARITY SENSE F/F) to switch on.

Thus a reference signal of opposite polarity to the input signal is applied to the integrator to discharge the capacitor. The reference integration period required for discharging the capacitor to zero volts will always be less than 40 mS (except with an overload signal) and the instant of zero crossing is sensed by the Null Detector.

In order to overcome the problem of uncertainty near zero a small proportion of the reference voltage selected by the reference polarity detector Q14, Q15 is fed forward to bias the null detector. This means that even with zero input signal there is a small reference ramp lasting for a period of time determined by the amount of feedforward (set by R106). This is about 7 μS and has the advantage of ensuring that a null detector pulse cannot occur at the same time as the maximum digital noise occurs, i.e. at the end of SIG. Thus for zero input the display will read several digits and this is compensated for by holding the clock for a few counts during the reference period.

When the zero crossing is sensed by the Null Detector a pulse of about 1 mS duration appears at TP8, the leading edge of which is fed via pulse transformer TR3 to the Null Detector latch in the digital part of the circuit.

1.3.1.4 Reset Period

The pulse at TP8 changes over the POLARITY SENSE F/F and this sets the RESET F/F driving TP10 $\overline{\text{RESET}}$ to its negative state. This signal inhibits the reference switch lines via diodes D19 and D20, switching Q5 or Q6 off and removing the reference voltage input to the integrator.

RESET in its positive state via D18 turns Q4 on, completing the feedback loop so that any residual charge from the previous reading cycle is removed from the integrator capacitor C35. The circuit is thus reset ready for the next timing pulse.

1.3.1.5 References

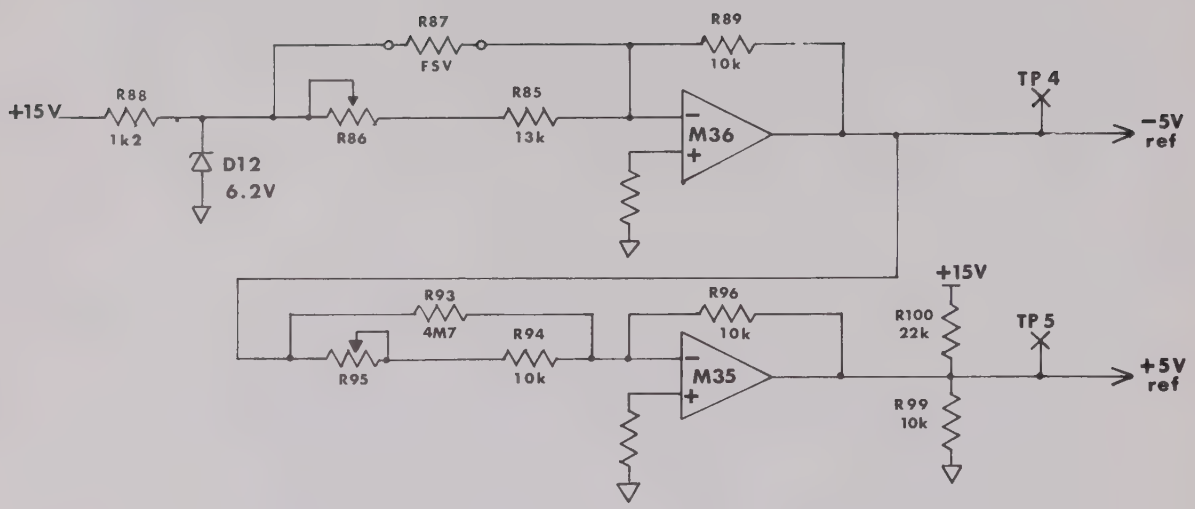


FIG 1.8 REFERENCE CIRCUIT

Fig. 1:8 shows the circuitry for producing the stable +5 V and –5 V reference voltages. The stability of the reference is dependent upon the inherent stability of the reference zener D12.

To obtain the +5 V reference required, inverting amplifier M36 is used with R87 and trimming pot R86 to adjust the output to –5 V. Similarly another inverting amplifier M35, having unity gain, and trimmed by R95 is used to produce the +5 V reference.

1.3.2 Digital Section

The simplified block diagram below illustrates the general arrangement of the digital circuitry.

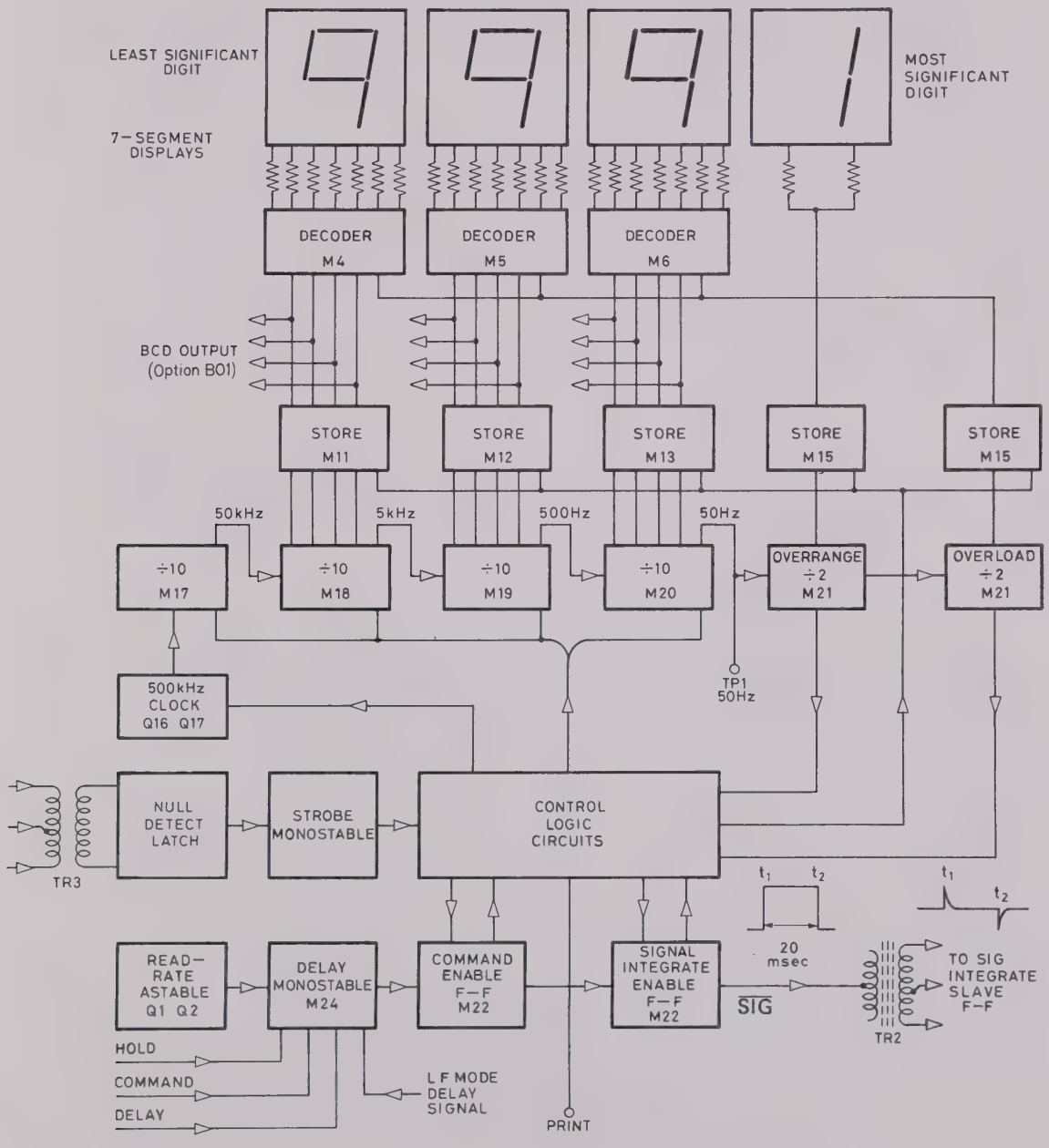


Fig.1.9 Simplified diagram of digital circuit

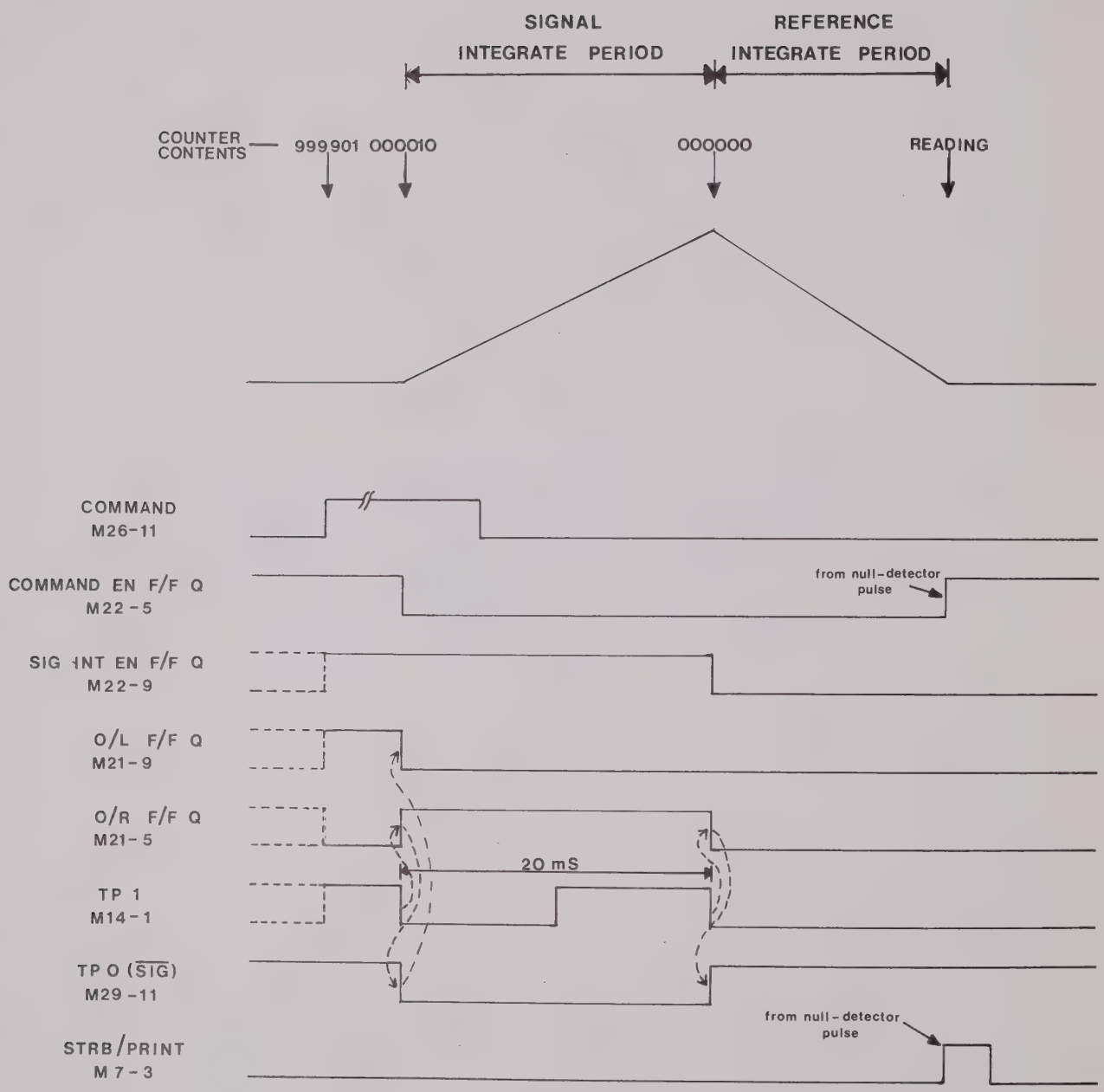


FIG 1.10 DIGITAL SECTION TIMING DIAGRAM

1.3.2.1 **Command**

In normal operation the read/rate astable (Q1 and Q2) provides commands 3 times/sec to the control logic. A null detector pulse, produced at switch-on at the end of a cycle, sets the Command Enable F/F which allows the commands through to the control logic.

Upon receipt of a command, the decade counters M17 – M20 are preset to 9, the overrange F/F is reset and the overload F/F is set, so the count is

9 9 9 9 0 1

NOTE: In this and all subsequent explanations the least significant digit is shown on the left.

The Signal Integrate Enable F/F is also set.

1.3.2.2 **Signal Integrate Period**

The first pulse from the 500 kHz clock (Q16 and Q17) changes the states of the decade counters and overrange F/F.

The change in state of the overrange F/F causes TP0 ($\overline{SIG}$) to go to 0 indicating the start of the signal integrate period.

In the digital circuitry this holds the overload F/F reset and thus the count is:–

0 0 0 0 1 0

$\overline{SIG}$ also resets the command enable F/F to inhibit any further commands.

$\overline{SIG}$ is fed via TR2 to the analog circuits where it enables the connection of the input signal to the integrator.

1.3.2.3 **Reference Integrate Period**

After 10000 clock pulse (20 mS) the overrange F/F resets and as the overload F/F is still held reset the count is now:–

0 0 0 0 0 0

TP0 ($\overline{SIG}$) returns to a logic '1' indicating the end of signal integrate period and in the analog circuitry this enables the correct reference to be connected to the integrator.

The signal integrate enable F/F is reset and the overload F/F reset is released.

The positive edge of $\overline{SIG}$ is slightly delayed to hold the counter for the first ten pulses of the clock in the reference period to compensate for the feed-forward in the analog circuit.

The counter is then released to count freely from 0 0 0 0 0 0 to time the reference period.

1.3.2.4 **Display and Reset**

One of the following four conditions can occur:–

i) Null detector pulse received within 20 mS – less than full range count.

Counter contents:– X X X X 0 0

The null detector pulse is received from the analog circuit via TR3 to trigger the Strobe Monostable and clock the value in the counters into the latches M10 – M13, M15. The values are then decoded and routed to the display board.

STRB and PRINT signals indicate that data is ready for use by the display or BCD outputs.

The command enable F/F is set to allow the next command pulse to initiate a new measurement cycle.

ii) Null detector pulse received between 20 mS and 40 mS – overrange count.

Counter contents:– X X X X 1 0

The sequence of events is the same as detailed in i) but the overrange F/F is set.

iii) Null detector pulse received between 40 mS and 60 mS – overload count.

Counter contents:– X X X X 0 1

The sequence of events is the same as detailed in i) but the overload F/F is set which blanks the display.

iv) **No** null detector pulse received before 60 mS – invalid or fault condition.

Counter contents:– 0 0 0 0 1 1

In this case protection logic is used to pre-set the command enable F/F to terminate the invalid cycle and allow a new measurement cycle to be initiated.

The above sequence is summarized in tabular form for reference in Fig. 1:11.

COUNTER SEQUENCE SUMMARY

(X = Undefined Digit)

	Least Significant DECADES				Most Significant BINARY Overrange	Overload
Initially	X	X	X	X	X	X
COMMAND sets to (Then starts count)	9	9	9	9	0	1
TIME (COMMAND +1 clock pulse) Start of SIGNAL INTEGRATE	0	0	0	0	1	0
TIME (20 msec later) i.e. 10 000 clock pulses End of SIGNAL INTEGRATE Start of REF. INTEGRATE	0	0	0	0	0	0
Null Detects at end of REFERENCE INTEGRATE						
Full Range	X	X	X	X		0
Full Range	X	X	X	X	1	0
Overload	X	X	X	X		1

ILLUMINATED

ILLUMINATED

FIG. 1:11

1.3.2.5 External Control

The internal commands from the read/rate astable may be inhibited by the $\overline{\text{HOLD}}$ external signal. A reading is then initiated by generating a command via the $\overline{\text{COMMAND}}$ line and the Delay monostable M24. A zero on the $\overline{\text{DELAY}}$ line will automatically insert a delay equal to the settling time of the analog circuitry depending on whether it is switched to NORMAL or FILTER.

1.4 DISPLAY

Assembly Drawing 400028.
Circuit Diagram 430006.

The Display comprises seven segment cold cathode (Beckman – Sperry) displays operating from a 180 V DC supply line. The complete assembly is mounted on the front of the A – D assembly and at right angles to it. The segment drive lines from the decoder drivers on the A – D pass via the soldered right angle connector directly to the pins on the displays. Decimal points DP2, DP3 and DP4 are also driven directly from the A – D assembly. The remaining decimal point, DP1, the overrange digit and the + and – indicators are driven from high voltage buffer transistors Q8, Q7, Q5 and Q6 mounted on the display board. These transistors are driven from TTL levels. The "V" and "mV" indicators are incandescent long life lamps driven directly by M1 which decodes signals presented by the A – D assembly.

1.5 POWER SUPPLIES

1.5.1 General

The mains transformer and power supply components are mounted near the rear of the Analog-Digital Display board. Transformer TR1 is of toroidal construction with a split primary comprising two 115-volt windings. These are intended for either series or parallel connection, depending on the supply voltage. An earth screen is interposed between the primary and secondary windings to minimize electrostatic coupling; this is grounded to supply-line earth. Completely separate from the earth screen, and isolated from all windings, a further electrostatic screen is fitted to act as a Guard Shield.

1.5.2 ± 15 V, + 5 V Supplies

There are three secondary windings from TR1, each with its separate full-wave bridge rectifier and solid-state regulator. Outputs from regulators M38 and M39 provide a – 15 V – COMMON – + 15 V DC supply, while an 8-volt r.m.s. winding is used with rectifier W1 and regulator M37 to give a separate +5 V line. The regulators used are all capable of delivering a 1-ampere output, with foldback current limiting and thermal shut-down protection built in. No damage results to them even under short-circuit conditions.

1.5.3 180 V Supply

The 180 V supply line is located on the display board as a DC to DC converter stepping up from the 5 V supply. The advantages of this method are two-fold, firstly it localises the presence of high voltages and secondly it is automatically regulated since the 5 V line is regulated. Transistors Q1 and Q2 form an astable multivibrator driving Q3 which switches one side of the primary of the toroidal transformer T1 to zero volts at an approximate 20 kHz rate. The Centre-tap connects to +5 V via R1 and C1 and the other half of the primary drives CR3 which acts as an efficiency diode.
W1 rectifies the high voltage square wave output, C1 smoothes out any spikes present and R6 and R8 feed the anodes of the display modules DM1 and DM2.

1.6 OPTIONS

1.6.1 BO1 BCD Output

This option comprises a printed circuit board which routes all data output and command signals between the A – D Converter and the 50-way Amphenol BCD connector located on the rear panel of the instrument. Refer to the Operating Manual for details of the pin connections.

1.6.2 BO2 3-state BCD Output. Assembly Drawing 400023. Circuit Diagram 430002.

This option comprises a printed circuit board which routes all signals as in Option BO1. Each line is input to a 3-state gate which is disabled by a logic '0' on the PRINT INHIBIT, Pin 42, input control line. This forces all outputs to a high impedance OFF state, which effectively disconnects all instrument outputs from the lines they are connected to and inhibits all input commands.

1.6.3 AO1 Analog Output (located on DC Isolator Board)

The analog output option comprises an amplifier, M3, and its associated circuitry which buffers the output of the DC converter to present a 0–2 V output via the connector located on the rear panel of the instrument. The output impedance is approximately 100 ohms and there is a fast acting fuse in the Hi line. Refer to the Operating Manual for details of the pin connections.

1.6.4 RO1 Parallel Rear Input

This option comprises a socket on the rear panel which is wired in parallel to the input terminals on the front panel. Refer to the Operating Manual for details of the pin connections.

1.6.5 FO1 Fast Read Rate

This option decreases the settling time of the input circuitry to allow up to 20 readings per second. On the DC Isolator C23, C24 and C25 are removed, C15 is changed to a 3300 pf capacitor, and C25 is changed to a 1000 pf capacitor. On the A – D Converter C20 is changed to a .33 μF capacitor.

This option degrades the AC Normal Mode Rejection.

SECTION 2

MAINTENANCE

2.1 INTRODUCTION

2.1.1 General

Regular maintenance of the instrument will enable the user to have confidence in measurements made as well as ensuring the highest accuracy possible.

Normally this will consist of checking the calibration at, or before, the end of the guaranteed specification validity period and adjusting where necessary.

Section 6 of the Operating Manual – Specification Verification – is a routine for checking the instrument is working within its specified accuracy and may be used as the first stage of an instrument check.

Any readings found to be grossly out of specification should be treated with suspicion as they may indicate a fault.

A routine calibration procedure is given in Section 2.2. of this Manual.

Following repair or component replacement, the procedures in Section 2.3.2 of this Manual relevant to the repaired part should be carried out prior to performing a full routine calibration.

Before attempting any calibration it must be ensured that the test equipment is of sufficiently high accuracy. The test equipment required is specified in Section 2.2.2. It is also recommended that Section 1, Technical Description, be read before commencing, in order that some idea may be gained of the purpose and possible interaction of the various adjustments.

The circuit diagrams and printed circuit board layouts are contained in Section 4 of this Manual.

In case of difficulties or for general advice in servicing your instrument, do not hesitate to contact our Customer Service Department (for the address and telephone number, see the front of this Manual).

2.1.2 Removal of covers – access to components

Access to the interior of the instrument for routine calibration, or repair, is achieved by removing the four screws securing the top cover, two screws at each side, and lifting the cover clear of the instrument. Removal of the bottom cover is achieved in a similar manner. The top cover provides access to the Analog to Digital Converter and the BCD Output Option. The bottom cover provides access to the DC Isolator board. With both covers removed the instrument is still operational. It may be inverted without component damage and full mechanical rigidity is maintained during servicing operations.

NOTE: The front panel terminals are insulated from the instrument case, enabling the internal circuitry to float at potentials greater than earth, so the potential of the internal Guard Shields can also reach dangerous levels. In addition, mains supplies appear on exposed conductors in the instrument. Therefore great care should be taken when handling an instrument with covers removed if the input terminals are connected to an external source or the mains supply is connected.

Access to the Display Board in instruments with the side handles is achieved by removing the front panel. Disconnect the mains supply to the instrument and any connections to the input terminals. Remove the top and bottom covers as described in previous paragraph. Disconnect all internal leads from the input terminals. Remove the four screws fastening the front panel to the side panels, two screws each side. Draw the front panel forward until it clears the switches and remove the front panel to gain access to the Display Board (it should not be necessary to disconnect the 'power ' switch).

N.B. In instruments with the front handle, access to the Display board is achieved by removing the screws retaining the A – D board and moving the whole assembly back until it clears the front panel.

2.2 ROUTINE CALIBRATION

2.2.1 General

The following section contains a calibration procedure which should be carried out at the end of the Specification Validity period, stated in Section 2.3.1 of the Operating Manual, or when the instrument is found to be out of specification.

Following repair or replacement of components, complete recalibration of the instrument should be carried out consisting of the part of Section 2.3.2 of this Manual applicable to the repaired board followed by the routine calibration.

Routine calibration should be completed at an ambient temperature of $23^{\circ}C \pm 1^{\circ}C$ for the instrument to meet its specification for the given operating range. Before commencing calibration, allow a minimum 2 hour warm up period with the upper and lower covers fitted in position but not fastened in place. The guard screens covering the boards should be left in place.

For the greatest accuracy and for minimum time spent calibrating it is necessary for the boards to remain at their normal working temperature throughout calibration. Each adjustment should be made as quickly as possible, in the order stated, and the covers replaced. Check the reading has stabilized before moving to the next step in the procedure.

After calibration procedure has been completed the instrument should be left in its normal operating position for at least one hour to ensure the internal temperature has fully stabilized. If the calibration procedure is now repeated it will be possible, with relatively few adjustments, to bring the instrument to optimum calibration.

2.2.2 Test Equipment

Test equipment specification for fault finding, calibration and performance verification is listed below. Generally the calibration source should have an accuracy specification exceeding that of the instrument by a factor of at least 4.

2.2.2.1 DC Calibrator

Precision DC Voltage source: Accuracy .003% or better.

Precision 100 : 1 attenuator: Ratio accuracy better than 10 ppm, nominal impedance 10 kΩ – 100 kΩ. (This needed where the calibration source does not have the required accuracy at 100 mV and 10 mV).

2.2.2.2 DC Voltmeter or Null Detector

High sensitivity fully floating DVM or null detector capable of resolving 10 μV.

NOTE: This item is not required for routine calibration if Analog Output Option is not fitted.

2.2.2.3 Timer or dual trace oscilloscope

Capable of measuring 20 mS. Accuracy : 0.05% or better.

2.2.3 Procedure

Drawing References: A – D Converter Board, Assembly Drawing 400027.
DC Isolator Board, Assembly Drawing 400030.

NOTE: For all the following adjustments select FILTER.

2.2.3.1 Integration Period Calibration

1. Sense the TTL pulse waveform on TP1 (Test Point) near M20 (digital board). Potentiometer R37 controls the period which should be set to give a period of 20.00 ± .01 mS, i.e. 50 Hz at the test point. In the U.S.A. and other countries where the supply-mains frequency is other than 50 Hz, the waveform period is set to the nominal mains period. Thus, in the U.S.A. set to 16.67 ± 0.01 mS, i.e. 60 Hz.

2.2.3.2 **Preliminary DC Isolator adjustments**

2. Select 10 mV range and connect a 10 MΩ resistor between Hi and Lo. Note the reading is noisy and takes some time to settle. Adjust R67 for less than 200 μV displayed (= 20 pA input current).

3. Leave on 10 mV range, and short input. Adjust R66 (Front Panel mV offset adjust) for zero displayed.

N.B. Steps 4 and 5 may be omitted if no Analog Output Option is fitted.

4. Switch to 10 V range and connect null detector or DVM between analog output Hi (or TP3) and input Hi. Adjust R73 for null or zero (± 30 μV).

5. With the null detector or DVM connected as before (step 4), switch to 1 V range and apply +1 Volt. Adjust R71 for null or zero ± 30 μV. Apply −1 V and check for null or zero ± 30 μV. The null detector may now be removed as the analog output is calibrated.

2.2.3.3 **A – D Converter Board adjustments**

6. With instrument on 10 V range and input shorted, adjust R75 for zero (bouncing polarity) on display.

7. Select 10 V range and apply + 1.7 mV. Adjust R106 for 1 bouncing to 2 digits displayed. Check displayed reading for inputs of ± 1 mV and ± 10 mV. These should be accurate to the least significant digit.

8. Select 1 V range and apply +1 Volt. Adjust R86 for +1.0000 displayed. Apply −1 Volt and adjust R95 for -1.0000 displayed.

2.2.3.4 **DC Isolator full range adjustments**

9. Select 10 V range. Apply +10 Volts and adjust R72 for +10.000. Apply −10 Volts. Check reading is −10.000 ± 1 digit.

10. Check ± 19.000 Volts reads correctly (± 3 digits).

11. Select 100 V range. Apply 100.00 Volts. Adjust R76 for correct display. Check for −100.00 Volts.

12. Select 1000 V range. Apply 1000.0 Volts. Adjust R75. Check −1000.0 Volts. (NOTE: Take care that > 500 V pk is not applied between signal Lo and earth).

13. Select 100 mV range. Apply +100.00 mV. Adjust R69. Check for −100.00 mV.

14. Select 10 mV range. Apply plus and minus 10.000 mV and adjust R70 for a total span of 20.000 mV e.g. +9.999 and −10.001 mV. Repeat until span is correct. This procedure is necessary due to thermal E.M.F's, which can be nulled out with the front panel mV offset control if desired.

The routine calibration is now completed and the covers should be secured.

2.3 REPAIR AND COMPONENT REPLACEMENT

2.3.1 General

IT IS RECOMMENDED THAT THIS SECTION BE NOTED BEFORE UNDERTAKING ANY REPAIR.

A fault in the analog circuitry will require the internal Guard Shields removing for access to the components and subsequent recalibration. Digital integrated circuits are fitted in sockets and can be replaced without disturbing the calibration of the instrument (although it is advisable to verify the performance after any component change.

The method of manufacture evolved by DATRON to ensure high reliability and stability involves elevated temperature 'burn-in' at both component and instrument level. In addition, operational amplifiers and other devices are selected for certain parameters. Hence many of the components used, although originally of a standard type, have a performance which can only be identified by a DATRON part number. These devices are held as stock items by DATRON who should be contacted if replacement is necessary.

Replacement of certain active devices and precision resistors also necessitates the re-selection of their associated F.S.V. (Factory Selected Value) resistors to accommodate component tolerances. These resistors, often high stability, metal film types, are used to preset an offset or reference setting, usually with fine adjustment provided by an associated potentiometer.

Replacement of analog components should be followed by re-calibration of the relevant part of the circuit as described in Section 2.3.2. Full routine calibration should then be carried out to ensure the instrument is within specification – if in any doubt consult our Customer Service Department.

When replacing semiconductor devices take great care to avoid overheating them during soldering . . . each joint being made as rapidly as possible. Although the use of a thermal shunt between semiconductor device and the soldered joint is strongly recommended, it is realised that it is impractical to use one in many instances . . . particularly when unsoldering a multi-lead device from a high density circuit board, a suction de-soldering tool is recommended.

When working on the isolator board, special consideration should be given to the effects of board leakage. Although active guarding is used extensively to reduce these effects, it should be borne in mind that because of the high input impedance and sensitivity involved, efforts should be made to remove all traces of flux after soldering.

2.3.2 Adjustments following component replacement

These procedures should be carried out with all boards mounted in the instrument. Guard shields should be removed to enable F.S.V's to be changed where necessary. (This will make the instrument slightly more noisy than in normal operation with the shields fitted).

Before proceeding with any adjustments, the instrument should be allowed a 30 minute 'warm-up' period after switch on.

NOTE: A small amount of interaction exists between certain controls, also the adjustment of certain controls has an effect which may not be immediately noticeable, i.e. zero drift with temperature. The user is therefore warned not to follow blindly all the sequences described, but to read and understand the reason behind each procedure, before embarking upon any actual adjustments on his own account. This approach should minimize the amount of time spent on recalibration, and in a number of instances, will eliminate upsetting preset adjustments which are already correctly set.

When the necessary procedures have been completed, all F.S.V. resistors should be soldered in position, the guard shields re-fitted, the instrument covers placed but not secured, in position and a routine calibration carried out as specified in Section 2.2.

2.3.2.1 Special Test Equipment

SQUARE WAVE GENERATOR.

Capable of supplying a 50Hz, 1V P/P square wave source.

NOTE: This item is only required for adjustments following repair to the DC Isolator Board or when Option FO1 is fitted.

TEMPERATURE CONTROLLED OVEN

Capable of maintaining the instrument at a known temperature of approximately 50^{o}C. Preferably with a glass inner door, if available.

THERMOMETER

Capable of reading ambient temperature.

NOTE: The above two items are only required after replacement of M1 on the DC Isolator Board.

2.3.2.2 **A – D Converter Board. Assembly Drawing No. 400027.**

Adjustments and sensing points are on the A – D Converter Board except where stated.

1. Set all preset potentiometers to mid-travel. Select 1 V range and apply short circuit input.

2. Connect DVM to +15 V gold terminal with respect to Analog Common, negative end of C23. Check the voltage is +15 V ± 300 mV.

3. Connect DVM to –15 V gold terminal with respect to Analog Common. Check the voltage is –15 V ± 300 mV.

4. Connect the Oscilloscope to C23 positive with respect to Analog Common. Check for 100 Hz (not 50 Hz) waveform.

5. Connect Oscilloscope to C24 positive with respect to Analog Common. Check for 100 Hz waveform.

6. Connect DVM to M23 Pin 14 with respect to Digital Common (Test Point near edge connector). Check for +5 V ± .25 Volts.

7. Connect Oscilloscope to C1 positive with respect to Digital Common. Check for 100 Hz waveform.

8. Connect DVM to W1 positive on Display Board with respect to Digital Common. Check for 180 V ± 20 volts.

9. Select 100 mV range. Check mV indicator illuminated.

10. Select 1 V range. Check V indicator illuminated.

11. Connect M27 Pin 9 to Digital Common. Connect oscilloscope to M26 Pin 11 with respect to Digital Common. Check for steady 0V with no positive pulses.

12. Connect oscilloscope to TP0 with respect to Digital Common. Check for steady +5 V (approx.) with no negative going pulses.

13. Connect oscilloscope to TP1 with respect to Digital Common. Check for 50 Hz square wave (or supply frequency).

14. Connect counter/timer to TP1 with respect to Digital Common. Adjust R37 for period of 20.00 ± .01 mS or frequency of 50 ± .025 Hz (or supply frequency ± .05%).

15. Connect oscilloscope to TP9 with respect to Analog Common. Check for –15 V. (If not, set by momentarily connecting TP9 to –15 V and checking it has set).

16. Connect oscilloscope to TP10 with respect to Analog Common. Check for –15 V. (If not, set by momentarily connecting TP10 to –15 V and checking it has set).

17. Connect DVM to TP3 with respect to Analog Common. Adjust R75 for reading of 0 ± 50 μV. If adjustment of R75 does not bring reading within specified limit, re-centralise R75 and re-select FSV resistors R69 and R70 to give 0 ± 1 mV. Adjust to 0 ± 50 μV with R75.

18. Connect DVM to TP6 with respect to Analog Common. Select FSV resistor R104 and R105 to give reading of 0 ± 500 μV.

19. Connect DVM to TP7 with respect to Analog Common. Check voltage is 0 ± 10 mV.

20. Connect DVM to TP8 with respect to Analog Common. Check voltage is 6.5 ± 1 volt. (TP8 has about 1 volt peak to peak noise).

21. Connect DVM to TP4 with respect to Analog Common. Check voltage is –4.75 ± .25 volts.

22. Connect DVM to TP5 with respect to Analog Common. Check voltage is + (voltage at TP4) ± 10 mV.

23. Apply ± 1.9 volts. Check

    i) TP3 with respect to Analog Common swings ± 9.5 volts ± 10 mV.
    ii) TP8 with respect to Analog Common does not move by more than ± 100 mV.

24. Apply short circuit input.

    Remove digital common from M27 Pin 9. Connect oscilloscope to TP0 ($\overline{SIG}$) with respect to Digital Common. Check for 20 mS negative going pulses, from +5 V to 0 V, at approx. 3 per second.

25. Connect oscilloscope to TP9 with respect to Analog Common. Check for positive going SIG pulses from −15 V to +12 V at approx. 3 per second.

26. Check display indicates 0 ± 10 digits.

27. Ensure short circuit input.

    Connect oscilloscope to TP8 with respect to Analog Common. Adjust R75 until pulse keeps reversing polarity.

28. Check polarity display bounces ±.

29. Apply + .00017 volts. Adjust R106 so display shows even bouncing between 1 and 2 digits.

30. Apply −.00016 to −.00018. Check display bounces −1/−2 digits for this range of input. Re-select FSV R112 if necessary (higher value of R112 will give higher negative polarity reading, lower value will give higher positive polarity reading).

31. Repeat steps 27, 28, 29 and 30 until satisfactory.

32. Apply +1.0000 volts. Adjust R86 for a display of +1.0000. If R86 adjustment insufficient, re-centralise potentiometer, re-select FSV resistor R87 to give a display of 1.0000 ± .0010 and re-adjust R86 for exact nominal reading.

33. Apply −1.0000 volts. Adjust R95 for a display of −1.0000.

34. Apply ± 1.9000 volts. Check display is ± 1.9000 ± .0001.

35. Apply > 2 volts. Check display blanks.

36. Apply short circuit input. Switch through ranges and check decimal points and zero blanking as shown below.

Range	DP & Zero blanking
10 mV	. X X X
100 mV	. X X
1 V	. 0 0 0 0
10 V	. 0 0 0
100 V	. 0 0
1 kV	. 0

37. Solder in FSV resistors and replace guard shield.

This completes the adjustments of the A – D Converter Board necessary following component replacement.

Proceed to Section 2.3.2.2 if any components have been replaced on the DC Isolator Board.

If the DC Isolator Board has not been disturbed, reposition, but do not secure instrument covers and proceed to Section 2.2, ROUTINE CALIBRATION.

2.3.2.3 **DC Isolator Board.** **Assembly Drawing No. 400030.**

The test equipment is as specified in Section 2.2.2.

The DC Isolator set-up may be sub-divided as follows:–

1. Display.
2 & 3. Voltage supplies.
4 – 8. Range switching (including F.E.T's).
10 – 13. Board Zero.
14 – 18. Bootstraps check.
19 – 21. Bias current adjust.
22 – 24. Response time and filter rejection.
25. Option FO1.
26 – 46. Zero drift compensation (only necessary after replacement of M1).

1. Select each range in turn and ensure correct decimal point and indicator lamp displayed.

Range	D.P.	Indicator
10 mV	± 0/1 X . X X X	mV
100 mV	. X X	mV
1 V	. X X X X	V
10 V	. X X X	V
100 V	. X X	V
1 kV	. X	V

2. Connect DVM to TP5 (Test Point 5) with respect to Signal Common, near TP1. Check voltage is +37 V ± 2 volts.

3. Connect DVM to TP6 with respect to Signal Common. Check voltage is –37 V ± 2 volts.

4. Select 10 mV range. Apply 20 mV. Connect DVM to TP3 with respect to Signal Common. Check voltage is 2.00 V ± 250 mV.

5. Select 100 mV range. Check voltage at TP3 is 0.20 V ± 25 mV.

6. Select 1 V range. Check voltage at TP3 is 0.02 V ± 5 mV.

7. Select 100 V range. Apply 20 volts. Check voltage at TP3 is 0.20 V ± 5 mV.

8. Select 1 kV range. Check voltage at TP3 is 0.02 V ± 5 mV.

9. Where amplifier M1 has been replaced, steps 26 to 30, part of the Zero drift compensation procedure, should be performed in place of step 10. If amplifier M1 has not been replaced, continue with step 10.

10. Select 1 V range. Short together pins marked GND I/P (TP1 and Signal Common). Connect DVM to TP9 with respect to Signal Common and adjust R74 for a reading of 0 ± 30μV.

11. Select 10 mV range. Connect DVM to TP2 and adjust R66 (front panel mV offset) for a reading of 0 ± 300 μV.

12. Select 1 V range. Connect DVM to TP3 with respect to Signal Common. Adjust R35 to give a reading of $<$ 20 μV.

13. Select each range in turn. Check total variation in reading is $<$ 20 μV except on the 10 mV range which may be 10 μV more.

14. Remove connection between TP1 and Signal Common. Select 10 V range. Connect DVM to TP7 with respect to TP9. Apply +20 volts. Check voltage is 9.5V ± 1 volt.

15. Apply –20 volts. Check voltage does not alter from value in 14 by more than ± 100mV.

16. Connect DVM to TP8 with respect to TP9. Check voltage is 9.5V ± 1 Volt.

17. Apply +20 volts. Check that change in voltage is < 10mV.

18. Connect DVM to TP9 with respect to Signal Common. Apply ± 20V. Check voltage varies between ±20V.

19. Select 10mV range. Select FILTER. Connect DVM to TP2 with respect to Signal Common. Apply a 10MΩ resistor across the input. Adjust R67 to give a reading of < ± 10mV. (The signal will appear noisy).

20. Remove and re-select FILTER. Check reading does not change by > 10mV.

21. Apply short circuit input. Adjust R66 to give a voltage of < ± 200μV at TP2.

22. Select 1V range. Apply 50Hz 1V p/p square wave. Connect oscilloscope to TP3 with respect to Signal Common. Check waveform is between 80mV and 100mV peak to peak.

23. Check peak to peak waveform at TP3 is between 1.5mV and 2mV.

24. Select 10mV range. Apply short circuit input. Connect DVM to TP3 with respect to Signal Common, and check indicated LF noise is < 200μV peak to peak.

25. This check is only necessary when Option FO1 is fitted.

    Select 1V range. Ensure FILTER out. Apply 50Hz, 1V p/p square wave. Connect oscilloscope to TP3 with respect to Signal Common. Check that the rise time (10% – 90%) of the square wave is < 1mS. Check there is no ringing and that it seems likely a final value (to .01%) is reached within 5mS.

This completes the post-repair procedures for the DC Isolator Board.

If M1 was replaced, continue with Step 32.

Zero Drift Compensation procedure.

26. Remove F.S.V. resistors R13, R22, R8 and R16.

27. Select 100mV DC. Set the mV offset potentiometer, R66, on the front panel of the instrument to the centre of its span. Connect the DC Voltmeter to TP9 with respect to Signal Common. Short together the pins marked 'GND I/P' on the DC Isolator. Adjust R74 for the same voltage indication on the DC Voltmeter as on the instrument's own display ± 50μV.

28. Zero instruments display with F.S.V. resistors R13 and R22 ± 20 digits. Do not solder in these resistors. Use metal film resistors (50ppm/^{o}C) for values below 1MΩ.

29. Adjust R74 for same voltage indication on the DC Voltmeter as on the instrument's display ± 20μV.

30. Repeat steps 28 and 29 if the instrument's displayed zero is greater than 20 digits. Remove the DC Voltmeter from TP9.

31. Complete the pre-calibration procedure given in Section 2.3.2.2, steps 11 to 25 to ensure that the DC Isolator functions correctly.

32. Select 100mV DC. Apply a short circuit input to the instrument and zero the display using the mV offset control, R66. Note the ambient temperature with the Thermometer.

33. Place the instrument in the Temperature Controlled Oven at approximately 50^{o}C with power 'on'.

34. Leave the instrument in the Oven for at least one hour then note the reading on the display and the temperature of the oven. (Take care not to create draughts when opening the oven door; an oven with glass inner door is ideal if available).

35. Compute:

a) the drift of the instrument in μV.

i.e. Drift = $\pm$ Displayed offset in Oven (Step 34) $\pm$ Displayed offset at ambient (Step 32).

b) the temperature rise of the instrument in ^{o}C.

i.e. Temperature rise = Oven temperature (Step 34) – Ambient temperature (Step 32).

c) the offset drift per degree of temperature rise.

i.e. Drift/^{o}C = $\pm$ Drift/Temp. rise = Step 35(a)/Step 35(b).

The maximum drift should be less than 0.3μV/^{o}C.

36. If the drift is greater than 0.3μV/^{o}C, the following procedure is repeated until the drift is within the required specification. If the drift is within 0.3μV/^{o}C. complete Steps 45 and 46.

37. Remove the instrument from the Oven and allow to stabilize, with power 'on' to ambient for one hour.

38. Compensation is achieved by adjusting R13 and R22 to produce an offset in the opposite direction to the drift obtained in Step 35(c). The magnitude of the offset is $\frac{\Delta Vt}{6.6}$ where ΔVt is the calculated drift in μV/^{o}C.

e.g. If the drift is measured as +100μV in a temperature rise of 30^{o}C, then the drift/^{o}C is +100μV/30^{o}C = +3.3μV/^{o}C. Hence the compensation required is:

$$\frac{\Delta Vt}{6.6}\,mV = \frac{3.3}{6.6}\,mV = 500\mu V$$

Since the drift was positive this would require negative compensation, i.e., –500μV. Hence, if the temperature rise is approximately 30^{o}C, then the magnitude of the offset should be about 5 times the magnitude of this drift. The 5 : 1 factor should be reduced if it over-compensates.

Do not solder in position R13 or R22.

39. Connect the DC Voltmeter to TP9 with respect to Signal Common, and adjust R74 for an indication of zero $\pm$ 20μV on the DC voltmeter.

40. In general, after Step 38 there will be fixed offset which must be zeroed without affecting the temperature compensation. This is achieved by selecting a link between R16 and +BS or –BS (at TP4 and TP8 respectively) and selecting R16 and R8 to reduce the offset to zero $\pm$ 20 digits with R66 adjusted to the centre of its span. Do not solder R16 or R8 into position.

41. Adjust R66, mV offset, for zero indication on the instrument's display.

42. Select 10, DCV and zero the instrument's display by adjustment of R67, current zero.

43. Repeat Steps 41 and 42 until the display reads zero without further adjustment.

44. Repeat the above procedure from Step 32 until the drift obtained in Step 35(c) is less than 0.3μV/^{o}C.

45. Select 100mV DC and check R66 mV offset has at least 0 $\pm$ 50 digits of span. If necessary, repeat Step 40.

46. Solder in all F.S.V. resistors and refit the environmental shield over M1.

This completes the Zero Drift Compensation procedure.

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1-R4	003223	22K 5% 2W CARBON	R.S.		4
R5	000823	82K 5% ¼W CARBON	MULLARD	CR25	2
R6-R7	000102	1K 5% ¼W CARBON	"	"	5
R8	440024	F.S.V.	WELWYN / HOLCO	4033C/H4	1 OF KIT
R9	000123	12K 5% ¼W CARBON	MULLARD	CR25	2
R10	011002	10K 1% ⅛W METAL FILM	WELWYN/HOLCO	4033C/H4	3
R11-R12	000221	220R 5% ¼W CARBON	MULLARD	CR25	2
R13	440023	F.S.V.	WELWYN/HOLCO	4033C/H4	1 OF KIT
R14	011004	1M 1% ⅛W METAL FILM	"	"	1
R15	011001	1K 1% ⅛W " "	"	"	1
R16	440024	F.S.V.	"	"	1 OF KIT
R17-R18	070067	20K 0·1% WIRE WOUND	MANN	MX125B	2
R19	070071	2K4 0·1% " "	"	"	1
R20	016808	68R 1% ⅛W METAL FILM	WELWYN/HOLCO	4033C/H4	1
R21	070068	2K2 0·1% WIRE WOUND	MANN	MX125B	1
R22	440023	F.S.V.			1 OF KIT
R23	000823	82K 5% ¼W CARBON	MULLARD	CR25	6
R24	000912	9k1 " " "	"	"	1
R25	000222	2K2 " " "	"	"	1
R28	000105	1M " " "	"	"	1
R31	070086	20K 0·1% WIRE WOUND	MANN	M3C-B	1
R32	070085	2K2 "	"	M3C-B	1
R33	000202	2K 5% ¼W CARBON	MULLARD	CR25	1

NOTES.

ISS. 10	11	12	13	14	15	16	17	18	19	20	21					
ECO 161	169	171	183	213	215	226	232	279	309	318	419					
ISS. 1	ISS. 2		ISS. 3.		ISS. 4		ISS. 5		ISS. 6		ISS. 7	ISS. 8		ISS. 9		
ECO. 2	ECO. 24		ECO. 61		E.C.O. 74		E.C.O 109		ECO. 128		ECO. 136	ECO. 140		ECO. 151		

DATE: 27.11.73

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PROD LAB 22-12

datron ELECTRONICS LTD.

TITLE: 1045 ISOLATOR P.C.B.

DRAWING NUMBER: 400030

SHEET 2 OF 2

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R34	000103	10K 5% 1/4W CARBON	MULLARD	CR25	5
R35	000473	47K 5% 1/4W "	"	"	1
R36	000363	36K 5% 1/4W "	"	"	1
R26, R27	000106	10M 5% 1/4W "	"	"	8
R29, R30, R37	000106	10M 5% 1/4W "	"	"	—
R38 - R39		NOT USED			—
R40	000106	10M 5% 1/4W CARBON	MULLARD	CR25	—
R41	000683	68K 5% 1/4W "	"	"	3
R42	000476	47M 10% 1/4W "	AB	CB	2
R43	000683	68K 5% 1/4W "	MULLARD	CR25	—
R44	000683	68K 5% 1/4W "	"	"	—
R45	000824	820K 5% 1/4W "	"	"	1
R46	000103	10K 5% 1/4W "	"	"	—
R47	012202	22K 1% 1/8W METAL FILM	WELWYN/HOLCO	4033C/H4	1
R48, R52	011002	10K 1% 1/8W "	" "	" "	—
R49	000103	10K 5% 1/4W CARBON	MULLARD	CR25	—
R50 - R51	011302	13K 1% 1/8W METAL FILM	WELWYN/HOLCO	4033C/H4	2
R53	000103	10K 5% 1/4W CARBON	MULLARD	CR25	—
R54 - R55	000273	27K 5% 1/4W "	"	"	2
R56 - R57	000104	100K 5% 1/4W "	"	"	—
R58	000102	1K 5% 1/4W "	"	"	—
R60 - R61	000106	10M 5% 1/4W "	"	"	—
A.N.1 *	090015	9M9 + 99K75 NETWORK	MANN		1
R59, R62 - R64		NOT USED			—

NOTES.

* ALTERNATIVE 090006 NETWORK ALLEN BRADLEY

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datron ELECTRONICS LTD.

TITLE 1045 ISOLATOR P.C.B.

DRAWING NUMBER 400030

SHEET 3 OF 9

ISS. 1	ISS. 2
ECO. 2	ECO. 24

SEE SHEET 2 FOR LATEST ISSUE

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R65	000123	12K 5% ¼W CARBON	MULLARD	CR25	—
R66	060105	1M MULTI-TURN CERMET POT	BECKMAN	79P	1
R67	063204	200K. 3/8" CERMET POT	"	72P	1
R68					
R69 - R70	063100	10R " "	"	"	3
R71	063500	50R " "	"	"	1
R72	063100	10R " "	"	"	—
R73	063104	100K " "	"	"	2
R74	063104	100K " "	"	"	—
R75 - R76	063501	500R " "	"	"	2
R77 - R78	000562	5K6 5% ¼W CARBON	MULLARD	CR25	2
R79 - R80	000102	1K 5% ¼W CARBON	"	"	—
R81 - R82	000107	100M 10% ¼W "	AB	CB	2
R83	000476	47M 10% ¼W "	"	CB	—
R84 - R85	000275	2M7 10% ¼W "	MULLARD	CR25	2
R86 - R88	000474	470K 10% ¼W "	"	"	3
R89 - R90	008007	10R 5% .2W CARBON FILM	"	CR16	2
R91	000103	10K 10% ¼W CARBON		CR25	—
R92 - R95	000104	100K 10% ¼W "	"	"	—
R96	000475	4M7 10% ¼W "	"	"	2
R97 *	000476	4M7 10% ¼W "	"	"	—
R98, R99		NOT USED			—
R100	090001	PTC THERMISTOR	MULLARD	VA8650	1

NOTES. * FITTED ONLY WITH NETWORK OPTION 090006

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R101	000270	27R 5% ¼W CARBON	MULLARD	CR25	2
R102	000270	27R " " "	"	"	—

NOTES.

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DATE 22.10.76

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TITLE 1045 ISOLATOR

DRAWING NUMBER 400030

SHEET 1 OF 1

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C10	150007	6·8µF 16V. TANT	UNION CARBIDE	K6R8E16	1
C1-C2	180006	47µf. 25V. AL. ELECT	WIMA	PRINTYLIT	2
C3-C4	180021	3·3µF 63V " "	MULLARD	015/18338	2
C5-C6	180022	33µF 40V " "	MULLARD	016/17339	2
C7-C8	180010	33nf 6V3 " "	WIMA	PRINTYLIT	2
C9	101103	10nf 250v CER. DISC	ERIE	801	3
C12	102330	33pf " "	"	"	1
C13	102228	2p2F " "	"	861	1
C14, C11	102471	470pf " "	"	801	4
C15	140005	0·15µf. 10% POLYPROPYLENE	WIMA	MKP10	2
C16	110002	0·15µf. 10% POLYESTER	MULLARD	C280	1
C17	140006	0·33µf. 10% POLYPROPYLENE	WIMA	MKP10	1
C18	120002	2µ2 160V. 10% POLYCARB	ADVANCE	CMR30A	1
C19	140005	0·15µf 10% POLYPROPYLENE	WIMA	MKP10	—
C20	101103	10nf 250v CER. DISC	ERIE	801	—
C21-C22	102471	470pf " "	"	"	—
C23	120004	0·68µf 63V. 10% POLYCARB	ADVANCE	CMD15A	1
C24	140004	·068µf 10% POLYPROPYLENE	WIMA	MKP10	1
C25	140003	47nf. "	"	"	1
C26	120006	470nf. 10% POLYCARB	ADVANCE	CMR10A	1
C27	101103	10nf. 250v. CER. DISC.	ERIE	801	—
C28	110017	22nf. 10% POLYESTER	MULLARD	C280	1
C29-C30	150001	22µf. 16V TANT	UNION CARBIDE	K22E16	2
C32-C33	102102	1nF. CER DISC	ERIE	801	2
C31		NOT USED			—

NOTES.

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SHEET 8 OF 9

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1-D2	200001	DIODE Si GP.	FAIRCHILD / MULLARD	IN4148	13
D3,	200001	" " "	" "	"	—
D4		NOT USED			—
D5	200001	DIODE Si GP.	FAIRCHILD / MULLARD	IN4148	—
D6, D7		NOT USED			—
D8-D12	200001	DIODE Si GP.	FAIRCHILD / MULLARD	IN4148	—
D13-D14	200008	LOW LEAKAGE DIODE		IN458A	14
D15, D16	200001	DIODE Si GP.	FAIRCHILD / MULLARD	IN4148	—
D17-D24	200008	LOW LEAKAGE DIODE		IN458A	—
D25		NOT USED			—
D26-D29	200008	LOW LEAKAGE DIODE		IN458A	—
D30, D31	210056	5V6 400mW ZENER		BZY88 C5V6	4
D32, D33	210056	5V6 400mW ZENER		BZY88 C5V6	—
D34, D35	210150	15V 400mW ZENER		BZY88 C15	2
D36, D37	210240	24V " "		BZY88 C24	2
D38, D39	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	—
Q1-Q3	230003	N-FET SWITCH G.P.	TELEDYNE	U1899E/K4093-18	5
Q4	230012	N-FET LOW LEAKAGE SWITCH	"	2N3824	3
Q5	230002	" " " "	"	U1994E/K4416-18	3
Q6, Q7	230012	" " " "	"	2N3824	—
Q8	230003	N-FET SWITCH G.P.	"	U1899E/K4093-18	—
Q9, Q10	230002	N-FET LOW LEAKAGE	"	U1994E/K4416-18	—

NOTES.

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DRAWING NUMBER 400030	SHEET OF 7 9

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q11	250006	SIL. PNP G.P.	FAIRCHILD	BC322	1
Q12	240006	SIL. NPN. G.P.	WAYCOM	2N3904	1
Q13	240014	SIL. NPN. G.P	FAIRCHILD	BC337	1
Q14	250004	SIL. PNP G.P.	WAYCOM	2N3906	1
Q15	250011	SIL. PNP. G.P.	FAIRCHILD	BC327	1
Q16	230003	N-FET SWITCH G.P.	TELEDYNE	U1899E/K4093-18	—
M1	290013	L.IC 312 SELECTED	NATIONAL	LM312H GREEN/WHITE	1
M2	290014	L. IC 312 "	"	" GREEN/ORANGE	1
M3	290007 or 290014	L. IC 312 "	"	" BLK or GR/ORANGE	1
M4-M6	290012	L. IC 741 "	FAIRCHILD	741 HC RED/ORANGE	3
	613011	NYLON WASHER			28
	630036	STEATITE INSULATING BEAD	PARK. ROYAL PORCELAINES	TYPE No 1	4
	613005	M3 SHAKEPROOF			9
	611006	SCREW POSIPAN M3 X 10mm			5
	614001	4mm x 3.3mm RIVET ST'OFF	HARWIN	CS2117B	6

NOTES.

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TITLE 1045 ISOLATOR PCB

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SHEET 8 OF 9

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
J3	605002	16 PIN D.I.L. SOCKET	ANTIFERENCE	16N-163-53	1
	602001	F.S.V. TERMINAL	MOLEX	02-04-1875	11
	601002	CONNECTOR TERMINAL	AMP	60803-1	7
	410002-8	P.C.B.	DATRON		1
	612005	23mm X M3 STAND OFF	HARWIN	CS2116	4
	450019	UPPER GUARD SHIELD			1
	450020	LOWER GUARD SHIELD ASSY			1
	620002	P.T.F.E. STAND OFF TERM'L	SEALECTRO	STS MIP47	4
S1-S6	700037	SWITCH BANK 6X6 POLE	LIPA * ISOSTAT	CD15	1 BANK
	700010	BUTTONS FOR 700026	" "		7
S7	700038	SWITCH PUSH ON/OFF	" "	CD15	1
	700010	BUTTON FOR 700027	" "	"	-
	450004	DRAUGHT SHIELD MOULDING	TIMPAK		1
	540001	24 SWG TINNED COPPER WIRE			A/R
	511001	7/·2mm P.V.C. 1KV WIRE			A/R
	611004	SCREW M3X6mm POZI-PAN			4
	590002	HELLERMAN SLEEVE H30x20mm	HELLERMAN ELEC.	H15x15	2
	620003	P.C.B. SOLDER TERMINAL	HARWIN	H2105A	6
	510111	7/·2mm. P.V.C. INSULATED (BROWN)			A/R
	510999	7/·2mm. P.V.C. INSULATED (WHITE)			A/R
	400032	INPUT CABLE ASSY		DATRON	1
	620001	PTFE CLOVERLEAF TERM'L	SEALECTRO	FT-E-12	1 **
	590004	SLEEVING - SILICON RUBBER	1·5mm		A/R

NOTES.

** QUANTITY 3 WHERE NETWORK AN1 090006 USED

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ECO. 2	ECO. 24

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ISS. 7 AD. 2.2.77	DRAWING NUMBER 400030
	SHEET 9 OF 9

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1 - R28		Not Used			-
R29-R31	000 273	27K 5% ¼W Carbon	Mullard	CR25	4
R32	000 104	100K 5% ¼W Carbon	Mullard	CR25	7
R33	000 103	10K 5% ¼W Carbon	Mullard	CR25	17
R34	000 47L	470R 5% ¼W Carbon	Mullard	CR25	2
R35	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R36	000 471	470R 5% ¼W Carbon	Mullard	CR25	-
R37	063 102	1K ⅜" Cermet Pot	Beckman	72P	1
R38	019 101	9K1 1% ½W Metal Film	Welwyn	4033C	2
R39	019 101	9K1 1% ½W Metal Film	Welwyn	4033C	-
R40	000 102	1K 5% ¼W Carbon	Mullard	CR25	3
R41	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R42	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R43	000 222	2K2 5% ¼W Carbon	Mullard	CR25	7
R44	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R45	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R46	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R47	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R48	000 331	330R 5% ¼W Carbon	Mullard	CR25	7
R49	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R50	000 393	39K 5% ¼W Carbon	Mullard	CR25	1
R51	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R52	000 104	100K 5% ¼W Carbon	Mullard	CR25	-

NOTES.

AP LAD 2-2-74

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ECO 71	ECO 82	ECO 87	ECO. 115	150	158	187	285	398	418

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datron ELECTRONICS LTD.

TITLE 1045 A-D PCB ASSY

DRAWING NUMBER 400 027

SHEET 2 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R53	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R54	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R55	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R56	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R57	000 223	22K 5% ¼W Carbon	Mullard	CR25	8
R58	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R59	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R60	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R61	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R62	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R63	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R64	000 561	560R 5% ¼W Carbon	Mullard	CR25	1
R65	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R66	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R67	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R68	000 331	330R 5% ¼W Carbon	Mullard	CR25	-
R69-R70	440 020	FSV (22K 5% Carbon)	Mullard	CR25	1 of Kit
R71	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R72	000 821	820R 5% ¼W Carbon	Mullard	CR25	1
R73	070 082	1KO .1% ¼W WW	Mann	M3C-B	1
R74	000 272	2K7 5% ¼W Carbon	Mullard	CR25	2
R75	063 104	100K ⅜" Cermet Pot	Beckman	72P	1
R76	070 083	4KO .1% ¼W WW	Mann	M3C-B	1

NOTES.

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DATE.	datron ELECTRONICS LTD.
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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R77 - R79	000 563	56K 5% ¼W Carbon	Mullard	CR25	4
R80	000 563	56K 5% ¼W Carbon	Mullard	CR25	-
R81	000 332	3K3 5% ¼W Carbon	Mullard	CR25	2
R82	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R83	000 562	5K6 5% ¼W Carbon	Mullard	CR25	3
R84	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R85	070 084	13K0 1% ¼W WW	Mann	MX125B	1
R86	063 500	50R ⅜" Cermet Pot	Beckman	72P	2
R87	440 021	FSV 220K 1% ¼W MF	Welwyn	4033C	2 of Kit
R88	011 201	1K2 1% ¼W MF	Welwyn	4033C	1
R89	070 066	10K0 .1% ¼W WW	Mann	MX125B	3
R90	000 562	5K6 5% ¼W Carbon	Mullard	CR25	-
R91	000 272	2K7 5% ¼W Carbon	Mullard	CR25	-
R92	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R93	000 475	4M7 10% ¼W Carbon	Mullard	CR25	1
R94	070 066	10K0 .1% ¼W WW	Mann	MX125B	-
R95	063 500	50R ⅜" Cermet Pot	Beckman	72P	-
R96	070 066	10K0 .1% ¼W WW	Mann	MX125B	-
R97	000 472	4K7 5% ¼W Carbon	Mullard	CR25	4
R98					
R99	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R100	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R101	014 702	47K 1% ¼W MF	Welwyn	4033C	1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R102	000 225	2M2 10% ¼W Carbon	Mullard	CR25	1
R103	000 473	47K 5% ¼W Carbon	Mullard	CR25	1
R104-R105	440 019	FSV (1M 5% ¼W Carbon)	Mullard	CR25	1 of Kit
R106	063 202	2K ⅜" Cermet Pot	Beckmann	72P	1
R107	000 472	4K7 5% ¼W Carbon	Mullard	CR25	-
R108	000 562	5K6 5% ¼W Carbon	Mullard	CR25	-
R109	000 107	100M 20% ¼W Carbon	AB	CB10	1
R110	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R111	000 124	120K 5% ¼W Carbon	Mullard	CR25	1
R112		FSV (6K8 5% Carbon)	Mullard	CR25	-
R113	000 332	3K3 5% ¼W Carbon	Mullard	CR25	-
R114	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R115	000 470	47R 5% ¼W Carbon	Mullard	CR25	1
R116	000 152	1K5 5% ¼W Carbon	Mullard	CR25	2
R117	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R118	000 273	27K 5% ¼W Carbon	Mullard	CR25	-
R119	000 101	100R 5% ¼W Carbon	Mullard	CR25	1
R120	000 472	4K7 5% ¼W Carbon	Mullard	CR25	-
R121-R122	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R123	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R124	000 472	4K7 5% ¼W Carbon	Mullard	CR25	-
R125	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R126-R128	000 104	100K 5% ¼W Carbon	Mullard	CR25	-

NOTES.

SEE SHEET 7 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
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REV.	DRAWING NUMBER 400 027 SHEET 5 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R129	000 152	1K5 5% ¼W Carbon	Mullard	CR25	-
R130	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R131-R132	000 223	22K 5% ¼W Carbon	Mullard	CR25	-
R133	000 684	680k 5% ¼W CARBON	"	CR25	1
R134	000100	10R 5% ¼W Carbon	Mullard	CR25	1
C1	180 004	4700mF F/16V Al. Elect	Wima	Printilyt 4700/16 New	1
C2	110 013	.1mF 250V Py.	Mullard	C280AE P100K	1
C3	150 003	47mF/63V Dipped Tant	Union Carbide	K47E6	1
C4 - C10	101 103	.01mF 250V Cer. Disc	Erie	801	11
C11	102222	2200pF 250V Cer. Disc	ERIE	801	1
C12	150005	2.2mF 16V Dipped Tant.	Union Carbide	K2R2E16	
C13-C14	150 001	22mF/16V Dipped Tant	Union Carbide	K22E16	5
C15	102 221	220pF Cer. Disc	Erie	801	2
C16	110 025	3300pF POLYESTER	MULLARD	347 61332	1
C17	102 47L	470pF 500V Cer. Disc	Erie	801	1
C18	102 221	220pf 500V Cer. Disc	Erie	801	-
C19	102102	1000pF 500V Cer. Disc	Erie	801	5
C20	150 009	3·3mF/=6V Tant Bead	Union Carbide	K3R3E16	1
C21	150 002	10 mF/16V Tant Bead	Union Carbide	K10E16	1
C22	110 004	.047mF 250V Py	Mullard	C280AE P47K	1
C23	180 005	1000mF/25V Al, Elect	Wima	Printilyt	2
C24	180 005	1000mF/25V Al. Elect	Wima	Printilyt	-

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE
CHECK	1045 A-D PCB
NEXT DRAWING	
REV	DRAWING NUMBER 400 027 SHEET 6 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C25	150 001	22mF/16V Dipped Tant	Union Carbide	K22E16	-
C26	150 001	22mF/16V Dipped Tant	Union Carbide	K22E16	-
C27-C28	102 470	47pF Cer. Disc	Erie	801	2
C29	102 102	1KpF Cer. Disc	Erie	801	-
C30-C31	102 101	100pF 500V Cer. Disc	Erie	801	3
C32-C33	102 102	1KpF Cer. Disc	Erie	801	-
C34	110 011	.47mF/100V Py	Wima	MKS 100V	1
C35	140 002	.47mF/400V d.c. 10% Polypro	Wima	MKP 10	1
C36	102 101	100pF Cer. Disc	Erie	801	-
C37	101 103	10nF 500V Cer. Disc	Erie	801	1
C38					
C39					
C40	101 103	.01mF Cer. Disc	Erie	801	-
C41	150 010	.33mF/35V Dipped Tant	Erie	801	1
C42	101 103	.01mF Cer. Disc.	Erie	801	-
C43	101 103	.01mF Cer. Disc	Erie	801	-
C44	Not Used				
C45-C46	110 012	150pF 10% 400V+300ppm Py	Wima	Tropyfol F	2
C47	102 102	1KpF CER DISC	ERIE	801	-
C48	150001	22mF/16V DIPPED TANT	UNION CARBIDE	K22E16	-

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE 1045 A-D PCB
CHECK RH	
NEXT DRAWING REV	DRAWING NUMBER 400 027 SHEET 7 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1-3	200 001	Sil Gen Purpose		IN4148	16
D4-6		NOT USED			
D7	200 001	Sil Gen Purpose		IN4148	-
D8	210 100	10V 400mW Zener		BZY88 C10V	1
D9-10	209 009	Matched Pair of 1N 458A			1
D11	200008	Sil Low Leakage		IN458A	1
D12	214 002	TC Reference Zener 6.2V	Centralab (Lucas)	IN827A	1
D13-24	200 001	Sil Gen Purpose		IN4148	-
W1	209 003	1.5 Amp 100V Rect. Bridge	G.I.	WS01	1
W2	209 004	1.0 Amp 100V Rect. Bridge	G.I.	W01	2
W3	209 004	1.0 Amp 100V Rect. Bridge	G.I.	W01	-

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE 1045 A-D PCB
CHECK JRP	
NEXT DRAWING	
REV -	DRAWING NUMBER 400 027 SHEET 8 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q1	240 006	Sil N.P.N. HF GP	Fairchild	2N 3904	5
Q2	240 006	Sil N.P.N. HF GP	Fairchild	2N 3904	-
Q3 - Q5 - Q6	239 011	Matched set of 3 Fets	Datron Sel. Teledyne	3 x U1994E ΔRon <30Ω	1 Set
Q4	230 002	Fet N Junct GP	Teledyne	U1994E/K4416-18	1
Q7	240 006	Sil N.P.N. HF GP		2N3904	-
Q8	240 006	Sil N.P.N. HF GP		2N3904	-
Q9	250 004	Sil P.N.P. HF GP		2N3906	3
Q10	240 001	Sil N.P.N. HiB GP		BC184K	4
Q11	240 001	Sil N.P.N. HiB GP		BC184K	-
Q12	240 001	Sil N.P.N. HiB GP		BC184K	-
Q13	240 001	Sil N.P.N. HiB GP		BC184K	-
Q14	250 004	Sil P.N.P. HF GP		2N3906	-
Q15	250 004	Sil P.N.P. HF GP		2N3906	-
Q16	240 007	Sil N.P.N. HF Switch		2N3646	2
Q17	240 007	Sil N.P.N. HF Switch		2N3646	-
Q18	240 009	Sil N.P.N. 80V Driver	Motorola	MPSL01	3
Q19	240 009	Sil N.P.N. 80V Driver		MPSL01	-
Q20	240 009	Sil N.P.N. 80V Driver		MPSL01	-
Q21	240 006	Sil N.P.N. HG GP	Fairchild	2N3904	-

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE 1045 A-D PCB
CHECK IKP	
NEXT DRAWING	
REV.	DRAWING NUMBER 400 027 SHEET 9 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	270 001	Dig IC Quad Nand		7400N Commerical	6
M2	Not Used				
M3	270 024	Dig IC 7Seg Decode	Sperry	DD700, DM8880	4
M4-M6	270 024	Dig IC 7Seg Decode		DD700	-
M7-M8	270 001	Dig IC Quad Nand		7400N Commercial	-
M9	270 006	Dig IC Hex Inv		7405N Commercial	1
M10-M13	270 026	Dig IC Quad Latch		74L75N Commercial	4
M14	270 005	Dig IC Hex Inv		7404N Commercial	1
M15	270 027	Dig IC Dual D FF		74L74N Commercial	1
M16	270 008	Dig IC Triple Nand		7410N Commercial	2
M17-M20	270 025	Dig IC Decade Count		74L90N Commercial	4
M21-M22	270 013	Dig IC Dual D FF		7474N Commercial	2
M23	270 001	Dig IC Quad Nand		7400N Commercial	-
M24	290 003	Timer Monostable	Signetics	NE555V Commercial	1
M25	270 002	Dig IC Quad Nand		7401N Commercial	1
M26	270 001	Dig IC Quad Nand		7400N Commercial	-
M27	270 008	Dig IC Triple Nand		7410N Commercial	-
M28	270 001	Dig IC Quad Nand		7400N Commercial	-
M29	270 023	Dig IC Quad Nand Buffer		7437N Commercial	1
M30		NOT USED			
M31		NOT USED			
M32	260 009	Linear IC LM318	National	LM318H	1
M33	290 009	Linear IC LM301A Op Amp	National	LM301AH Sel BLK/WHITE	* 1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE: 1045 A-D PCB
CHECK JRP	
NEXT DRAWING K=V	DRAWING NUMBER 400 027
	SHEET 10 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M34	290 011	Linear IC 741 Op Amp	Fairchild/Datron	741HC BLACK/WHITE	2
M35	290 011	Linear IC 741 Op Amp	Fairchild/Datron	741HC BLACK/WHITE	-
M36	290 023	Linear IC 741 Op Amp	Fairchild/Datron	741HC RED/WHITE	1
M37	260 005	Linear IC Power Regulator			
		5V	Motorola	MC7805	1
M38	260 006	Linear IC Power Regulator			
		15V	Motorola	MC7815	2
M39	260 006	Linear IC Power Regulator			
		15V	Motorola	MC7915	-
	613007	PLAIN WASHER M3	GKN		1
	611019	M3x35 POZIPAN	GKN		1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	TITLE 1045 A-D PCB
CHECK IAT	
NEXT DRAWING	
REV -	DRAWING NUMBER 400 027 SHEET 11 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
TR1	300 007	Toroidal Mains Tx	Plessey Windings		1
TR2, TR3	310 001	Pulse Tx (Logic)	Newport Inst.	76616/4	2
J3	605 002	16 way D.I.L. Socket	Antiference	ICN-163-53	1
	604017	MAINS CONNECTOR	MOLEX	10-08-1031	1
	620 003	PCB Solder Terminal	Harwin	H2105A	11
	602 001	FSV Terminal	Molex	0204 1875	14
	601 002	Connector Terminal	Amp	60803-1	8
	459 138	Transistor Heat Dissipator	KDP ES	459138	2
	459 139	Heat Dissipator	KDP ES	459139	1
	419 108A-4A	P.C.B.			1
	618 001	Transistor Mounting Kit			3
	611 006	M3 x 10mm Pozipan	GKN		3
	611 007	M3 x 6mm Pozipan	GKN		2
	615 002	M3 Nut	GKN		6
	630033	½"x 28SWG BRASS STRIP			30mm
	605038	16 way D.I.L. Skt	ASTRALUX	ICL 163-S6T	8
	605037	14 way D.I.L. Skt	"	ICL 143-S3T	21
	605 003	40 way DS .1" PCB Cnctr	Pye	MLD 205N0101 ML	1
	613005	M3 SHAKEPROOF			6
	450139	GUARD SHIELD			1
	612004	M3X4mm STANDOFF	HARWIN	CS2116-B	2

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

DATE.	datron ELECTRONICS LTD.
DRAWN BY.	
CHECK IRT	TITLE 1045 A-D PCB
NEXT DRAWING	
REV	DRAWING NUMBER 400 027 SHEET 12 OF 12

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
L_1	370 001	10 MICROH ·8R CHOKE	PLESSEY	58/10/0011/10	1
R_2	000 221	220R 5% ¼W CARBON	MULLARD	CR25	1
R_3, R_4	000 562	5K6 " " "	"	"	3
R_5	000 681	680R " " "	"	"	1
R_6	000 272	2K7 " " "	"	"	2
R_7	000 102	1K " " "	"	"	3
R_8	000 272	2K7 " " "	"	"	—
R_9	000 224	220K " " "	"	"	1
R_{10}, R_{11}	000 102	1K " " "	"	"	—
R_{12}	000 682	6K8 " " "	"	"	1
R_{13}	000 153	15K " " "	"	"	1
R_{14}	000 562	5K6 " " "	"	"	—
R_{15}	000 273	27K " " "	"	"	1
R_{16}	000 223	22K " " "	"	"	1
C_1	150 003	47mF, 20% 6·3V TANT BEAD	UNION CARBIDE	K47E6	1
C_2	110 013	·1mF 250V DIPPED PY	MULLARD	C280AE P100K	1
C_3 C_4	110 026	·0068mF 100V PY	WIMA	FKS 2 MIN	2
CR_1, CR_2	200 001	SIL GEN PURPOSE		IN4148	2
W_1	209 007	1·0 AMP, 400V BRIDGE		W04	1
CR3	200 002	1·0 AMP RECT		IN4001	1
Q_1, Q_2	240 001	SIL NPN Hi B GEN PURP		BC184K	2
Q_3	240 011	SIL NPN 1WATT SWITCH		BC338	1

NOTES. Q_4 NOT USED

ISSUE 3 23·4·75

ISS. 3	ISS. 4
ECO. 38	ECO 441

DATE. 26-11-73

DRAWN BY. JKP

CHECK JKD

NEXT DRAWING

datron ELECTRONICS LTD.

TITLE SPERRY DISPLAY PCB ASSY 1045

DRAWING NUMBER 400 028

SHEET 2 OF 2

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q5, Q6	240009	SIL NPN HI VOLT DRIVE	MOTOROLA	MPSL01	4
Q7, Q8	240 009	" " " " "	"	"	—
M1	270 023	QUAD NAND BUFFER		7437N	1
FL1	920 005	FILAMENT LAMP 5V 60mA	G.I.	V683	2
FL2	————	NOT USED			—
FL3	920 005	FILAMENT LAMP 5V 60mA	G.I.	V683	—
FL4	————	NOT USED			—
DM1	800 004	DISPLAY .3" ±1 8	BECKMAN	SP331	1
DM2	800 005	DISPLAY .3" 888	BECKMAN	SP333	1
T1	300 004	TORODIAL Tx 5V-180V 1.5VA			1
	800 007	SOCKET 2 DIGIT .3"	BECKMAN	CS 332	1
	800 008	SOCKET 3 DIGIT .3"	BECKMAN	CS 333	1
	604 003	CONNECTOR STRIP PINS 11WAY	AMP	163740-9	4
	602 004	DIL SOCKET STRIP	MOLEX	1938-4	14
	602 006	DIL SKT STRIP 7 WAY CARRIER	"	2460-7	2
	410009-4	THP PCB			1
	450 006	Tx SUPPORT BRACKET			1
	450 003	FUNCT. BLOCK INJ MOULD			1
	420 012	V, mV DISP NEGATIVE			1
	611 004	SCREW M3×6 POZIPAN			3

NOTES.

ISSUE 3 23-4-75

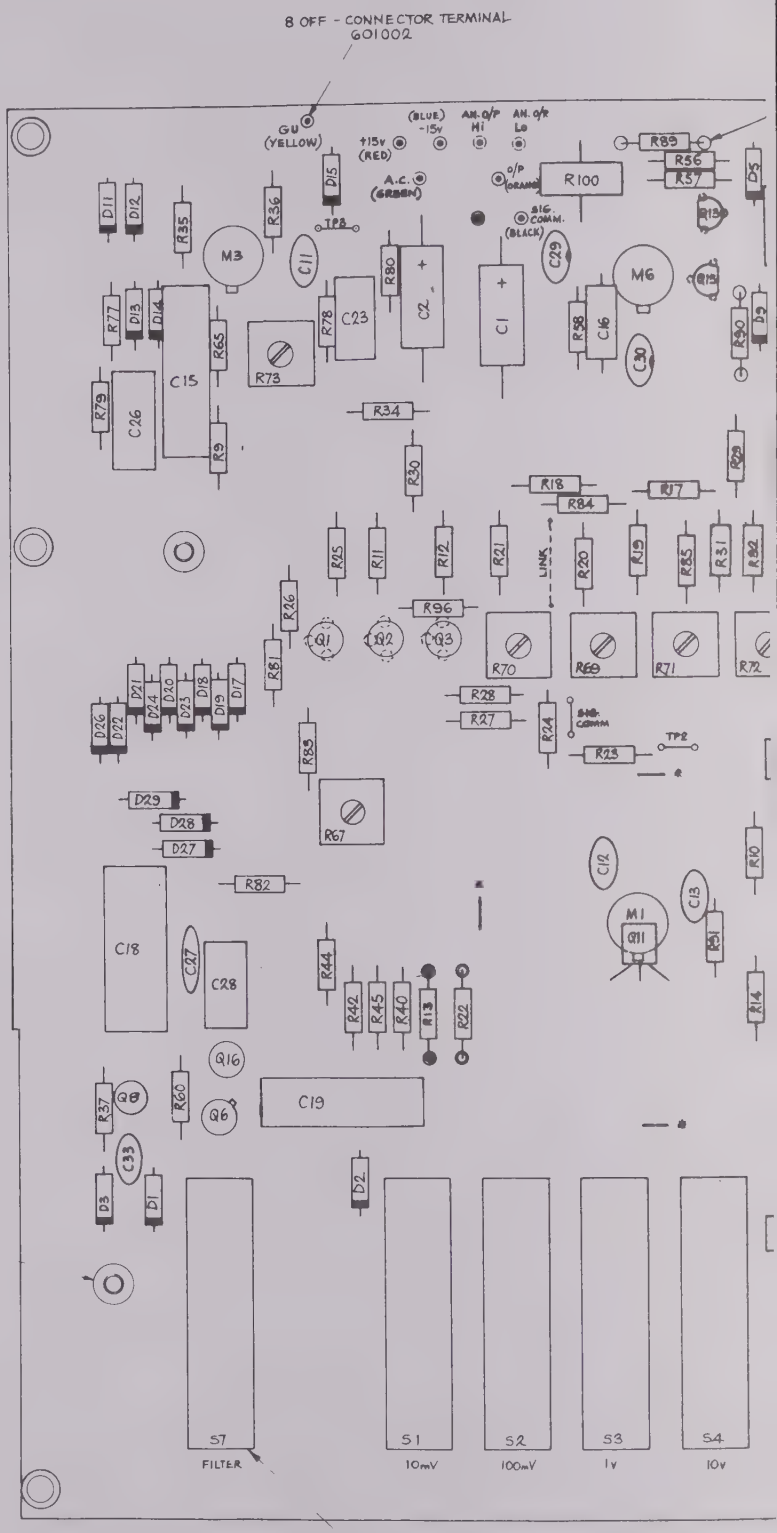
ISS. 3	
ECO, 38	

DATE. 26-11-73	datron ELECTRONICS LTD.
DRAWN BY. JKP	TITLE SPERRY DISPLAY PCB ASSY 1045
CHECK VIRD	
NEXT DRAWING	
(RCH) (AH). 2.2.77	DRAWING NUMBER 400 028 SHEET 3 OF 3

DRAWING No.	
400030	
FIRST USED ON	1045

THIRD ANGLE PROJECTION

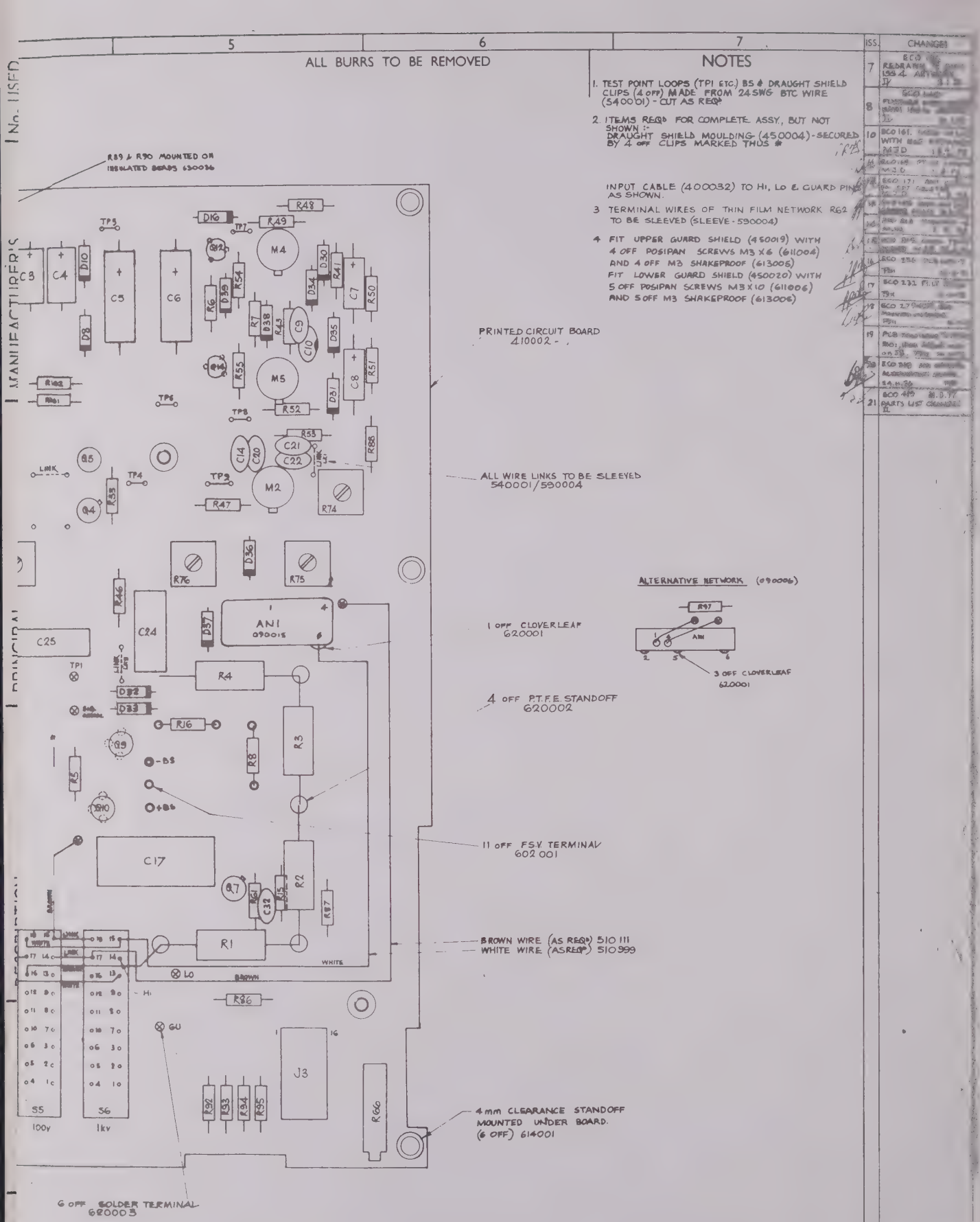
DRAWN IN ACCORDANCE WITH BS 308



4 OFF M3 STANDOFF
612003

MOUNT LIPA & ISOSTAT SWITCHES ON NYLON WASHERS (613011) 28 off.

DRAWN	CHECKED	DIMENSIONS IN
IV		MILLIMETRES
TRACED	APPROVED	SCALE
	L.A.D.	2:1
DATE	DATE	NOT TO BE SCALED
8.1.76.	2.2.77	


ALL BURRS TO BE REMOVED
NOTES
1. TEST POINT LOOPS (TP1 ETC.) BS & DRAUGHT SHIELD CLIPS (4 OFF) MADE FROM 24 SWG BTC WIRE (540001) - CUT AS REQD
2. ITEMS REQD FOR COMPLETE ASSY, BUT NOT SHOWN :- DRAUGHT SHIELD MOULDING (450004) - SECURED BY 4 OFF CLIPS MARKED THUS #
INPUT CABLE (400032) TO HI, LO & GUARD PINS AS SHOWN.
3 TERMINAL WIRES OF THIN FILM NETWORK RG2 TO BE SLEEVED (SLEEVE - 590004)
4 FIT UPPER GUARD SHIELD (450019) WITH 4 OFF POSIPAN SCREWS M3 X 6 (611004) AND 4 OFF M3 SHAKEPROOF (613005) FIT LOWER GUARD SHIELD (450020) WITH 5 OFF POSIPAN SCREWS M3 X 10 (611006) AND 5 OFF M3 SHAKEPROOF (613006)
ISS. CHANGES
R89 & R90 MOUNTED ON INSULATED BOARDS 630036
PRINTED CIRCUIT BOARD 410002 - ,
ALL WIRE LINKS TO BE SLEEVED 540001/590004
ALTERNATIVE NETWORK (090006)
R97
AIN
3 OFF CLOVERLEAF 620001
1 OFF CLOVERLEAF 620001
4 OFF P.T.F.E. STANDOFF 620002
AN1 090015
11 OFF F.S.V. TERMINAL 602 001
BROWN WIRE (AS REQD) 510 111
WHITE WIRE (AS REQD) 510 999
4 mm CLEARANCE STANDOFF MOUNTED UNDER BOARD. (6 OFF) 614001
6 OFF SOLDER TERMINAL 620003
S5 100v
S6 1kv
J3
M2
M4
M5
R74
R75
R76
R1
R2
R3
R4
R66
C17
C24
C25
-BS
+BS
LO
HI
GU
WHITE
BROWN
MANUFACTURERS
PRINCIPAL

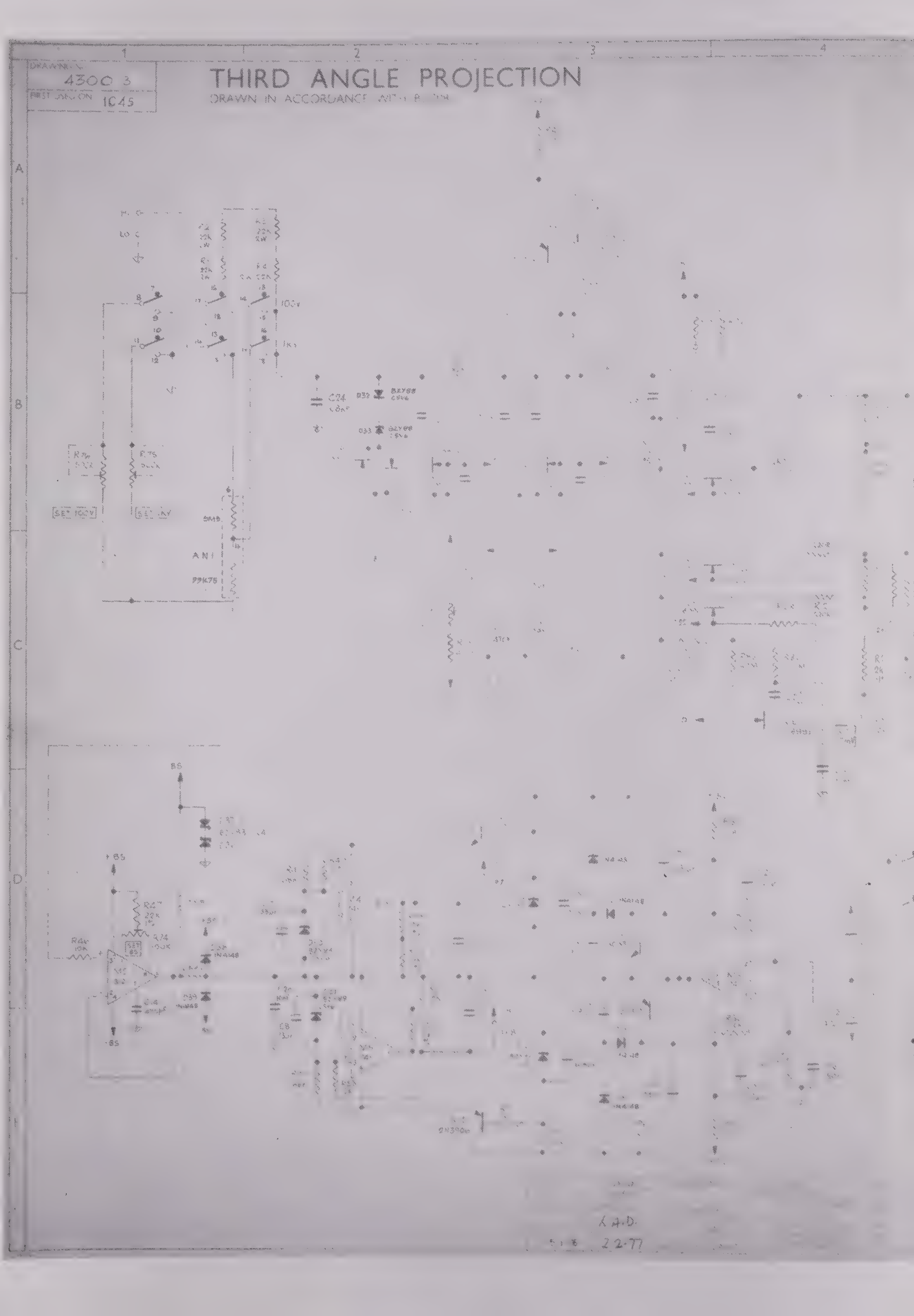
ANGULAR ± °	MATERIAL /	datron ELECTRONICS LTD. NORWICH.	DRAWING SIZE A1
	FINISH /	TITLE 1045 - D.C. ISOLATOR P.C.B. LAYOUT.	DRAWING No. 400030 SHEET 1 OF 1

DRAWING No. 4300 3

PRINT DATE ON 1045

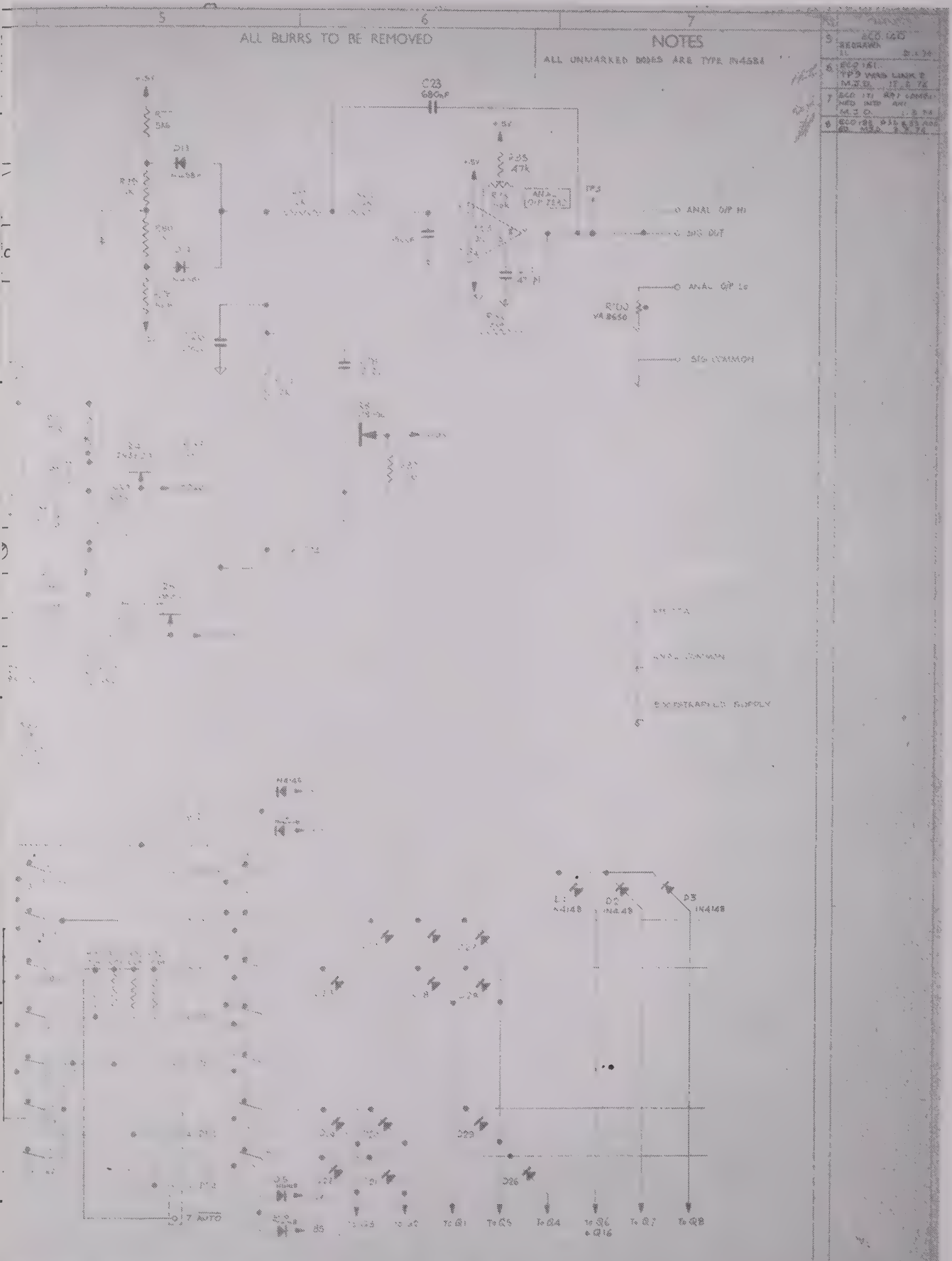
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



K.A.D.

22-7-77

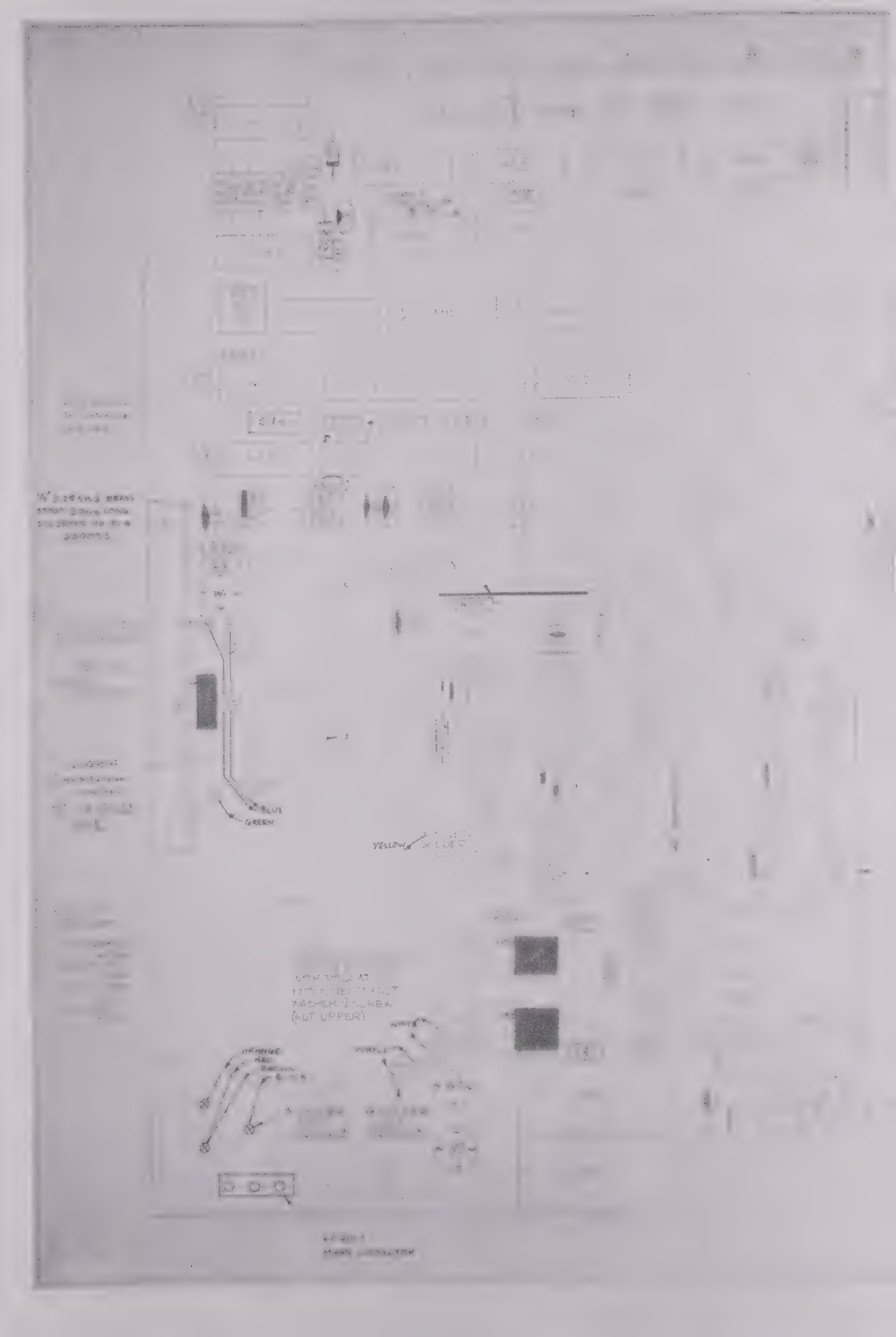


datron ELECTRONICS LTD. NORWICH.

1045 - D.C. ISOLATOR SCHEMATIC

DRAWING NO. 430013

DRAWING SIZE A1


BLUE
GREEN
YELLOW
WHITE
PURPLE

9 FIT GUARD SHIELD 450139 WITH
SCREW POSIPAN M3 X 6 (611007) 2 OFF
NUT M3 (615002) 2 OFF
SHAKEPROOF M3 (613005) 2 OFF
FIT NUTS ON TOP SIDE

DATE APP A.D. 22.77

ELECTRONICS LTD.

DRAWN BY

CHECK

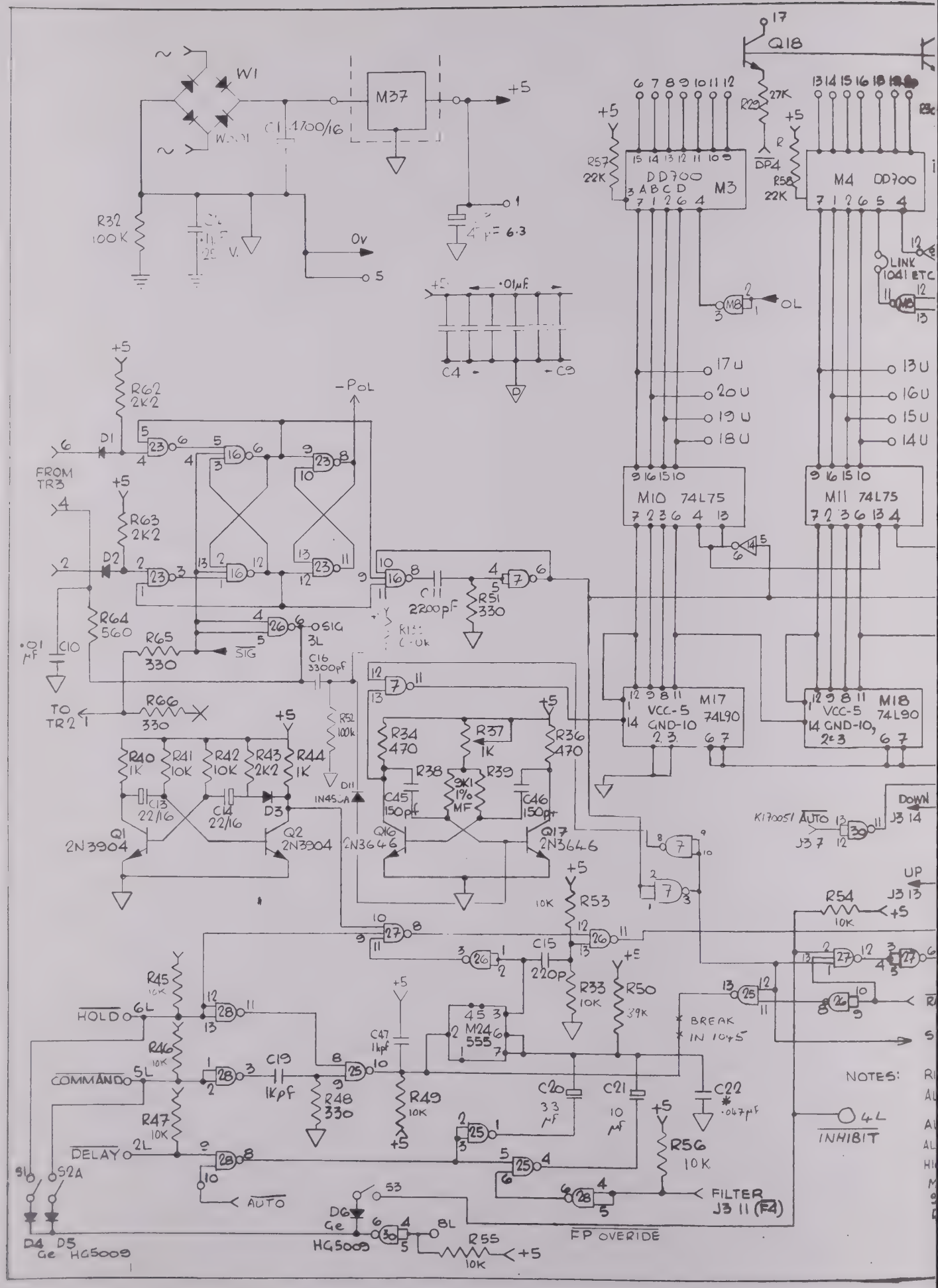
NEXT DRAWING 400021

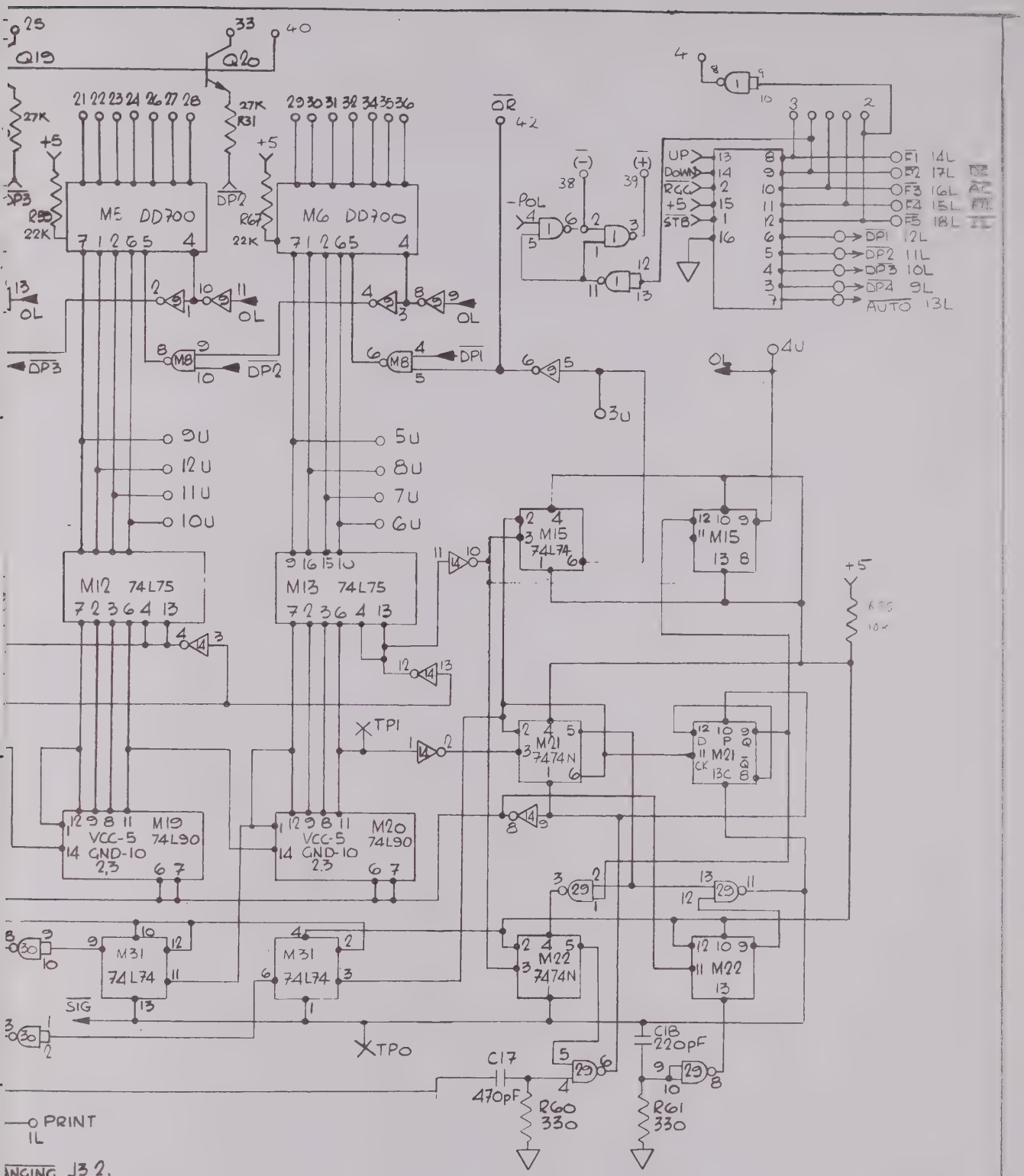
TITLE

ANALOG TO DIGITAL CONVERTER
1045

DRAWING NUMBER 400027

SHEET 1 OF 12


W1
M37
C1 1700/16
+5
0V
5
R32 100K
4µF = 6.3
·01µF
C4
C9
Q18
27K
R57 22K
R58 22K
DP4
DD700 M3
M4 DD700
LINK 1041 ETC
OL
17U
20U
19U
18U
13U
16U
15U
14U
M10 74L75
M11 74L75
R62 2K2
R63 2K2
D1
D2
FROM TR3
-POL
R64 560
R65 330
C10 ·01 µF
SIG
C16 3300pF
TO TR2
R66 330
C11 2200pF
R51 330
R40 1K
R41 10K
R42 10K
R43 2K2
R44 1K
C13 22/16
C14 22/16
D3
IN4504
Q1 2N3904
Q2 2N3904
R34 470
R37 1K
R36 470
R38
R39
9K1 1% MF
C45 150pf
C46 150pf
Q16 2N3646
Q17 2N3646
M17 74L90
M18 74L90
VCC-5
GND-10
DOWN
UP
J3 14
J3 13
J3 7
R53 10K
R54 10K
C15 220P
R33 10K
R50 39K
BREAK IN 1045
R45 10K
R46 10K
R47 10K
HOLD
COMMAND
DELAY
C19 1Kpf
R48 330
R49 10K
C47 1kpf
M246 555
C20 33 µF
C21 10 µF
C22 ·047µF
R56 10K
FILTER J3 11 (F4)
AUTO
S1
S2A
S3
D4 D5 Ge HG5009
D6 Ge HG5009
R55 10K
FP OVERIDE
NOTES:
4L
INHIBIT



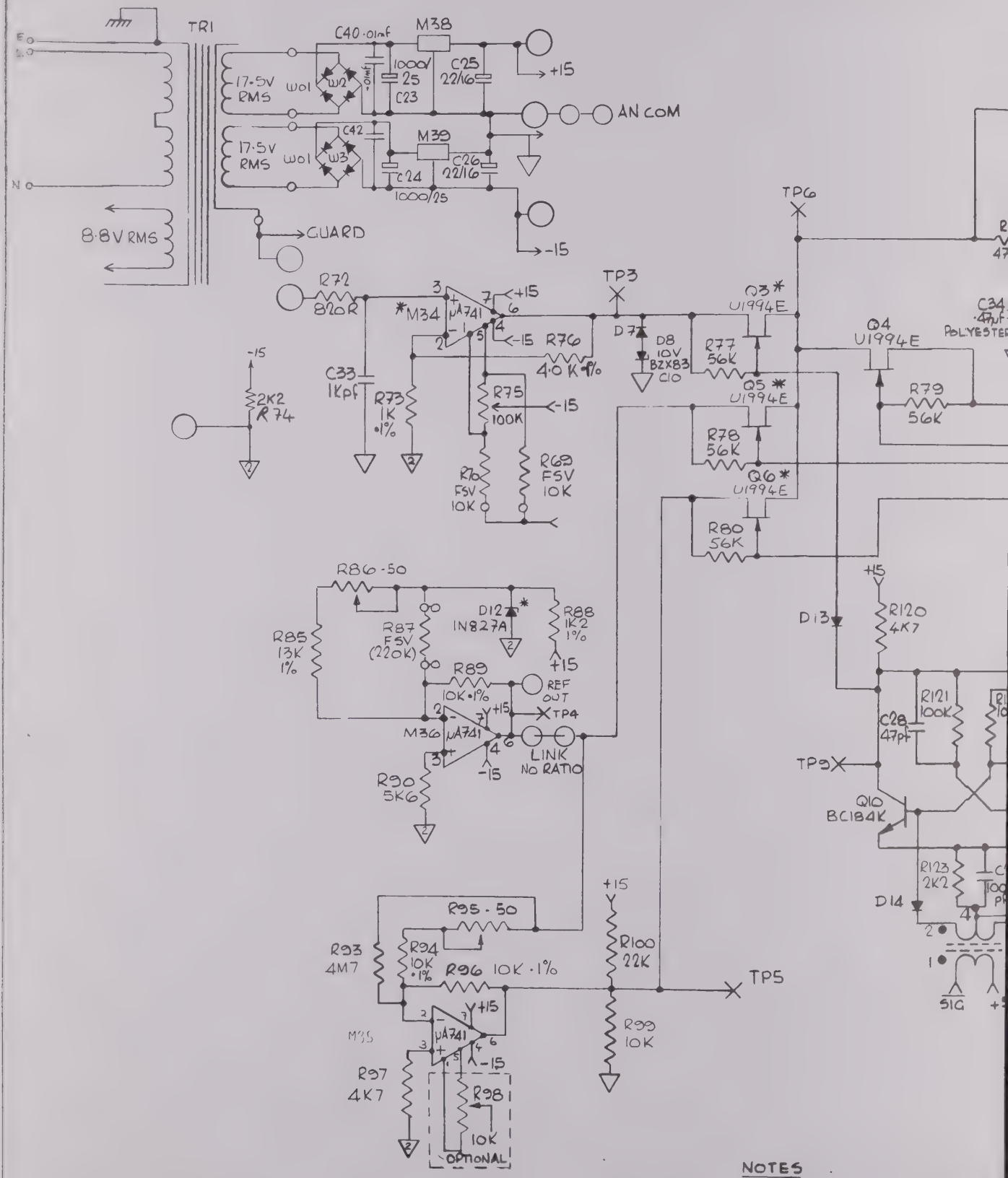
ANGING J3 2.

TRB J3 1.

- R28 NOT USED
- L OTHER UNMARKED R - 10K
- L UNMARKED D - IN4148
- L OPTION SHOWN INSTALLED
- HEST R67.

30 M31	NOT USED IN 1045	
1 S2 S3	" "	" 1045
4 D5 D6	" "	" 1045

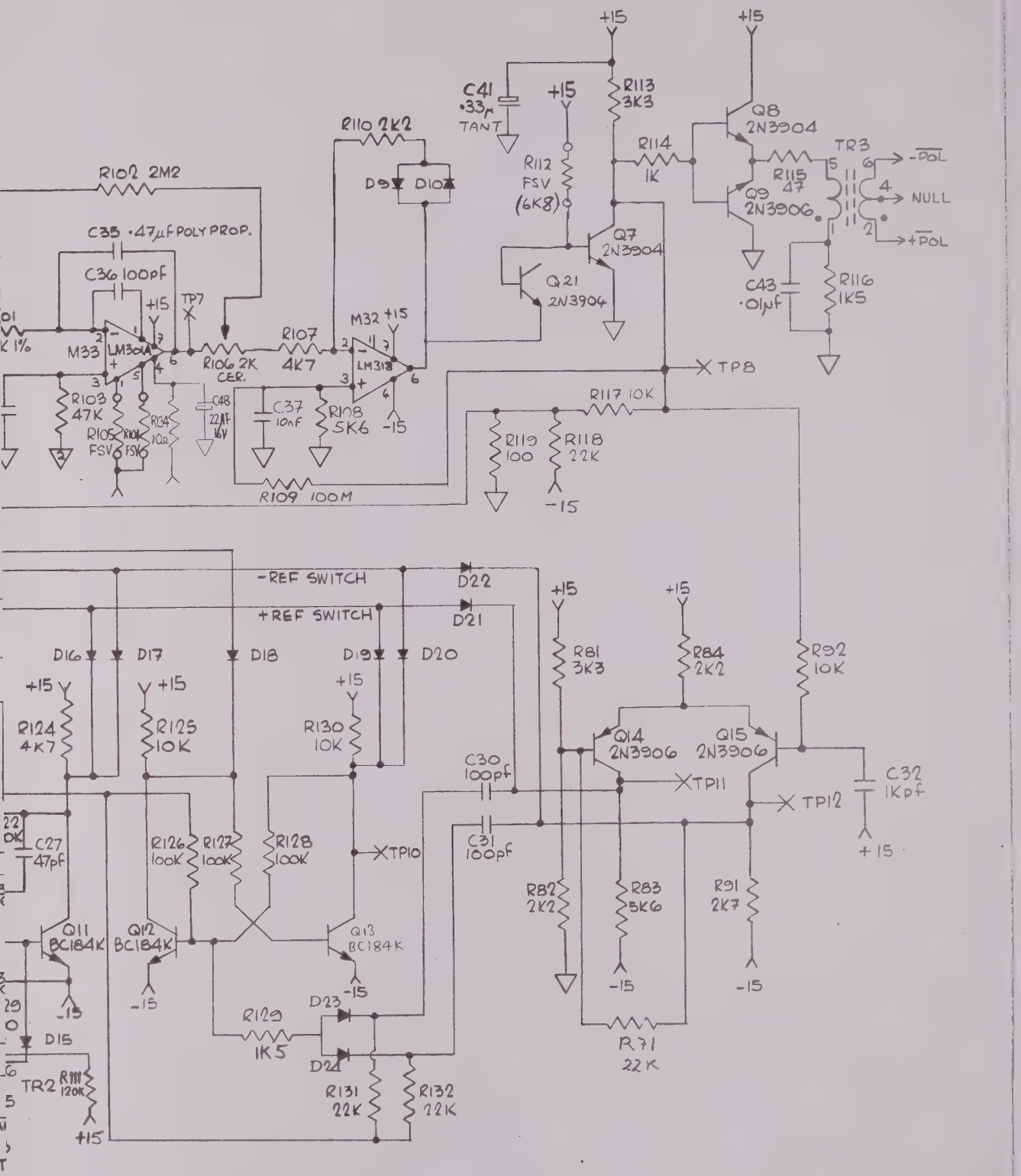
DATE 22-4-74		datron ELECTRONICS LTD	
R&D N.P		TITLE A-D DISPLAY DIGITAL SECTION 1045/1041	
CHECK D.C.			
PROD A.D.D. 2.2.77		DRAWING NUMBER 430004 ISSUE 23	SHEET 1 of 2
ISS. 3 ECO. 82	ISS 4 284	ISS 5 324	7 398



NOTES

ASTERISK INDICATES DATRON S

ALL DIODES IN4148 UNLESS N



ELECTED COMPONENTS

OTED OTHERWISE

	7	6	5	ISS. 4	ISS. 3
	SHT1	284	159 150	ECO 115 116	ECO. 86

DATE 18·4·74

R & D

CHECK

PROD. L. A. Dunn 2.7.77

NEXT DRG. PCB ASSY 409109/120

datron ELECTRONICS LTD

TITLE

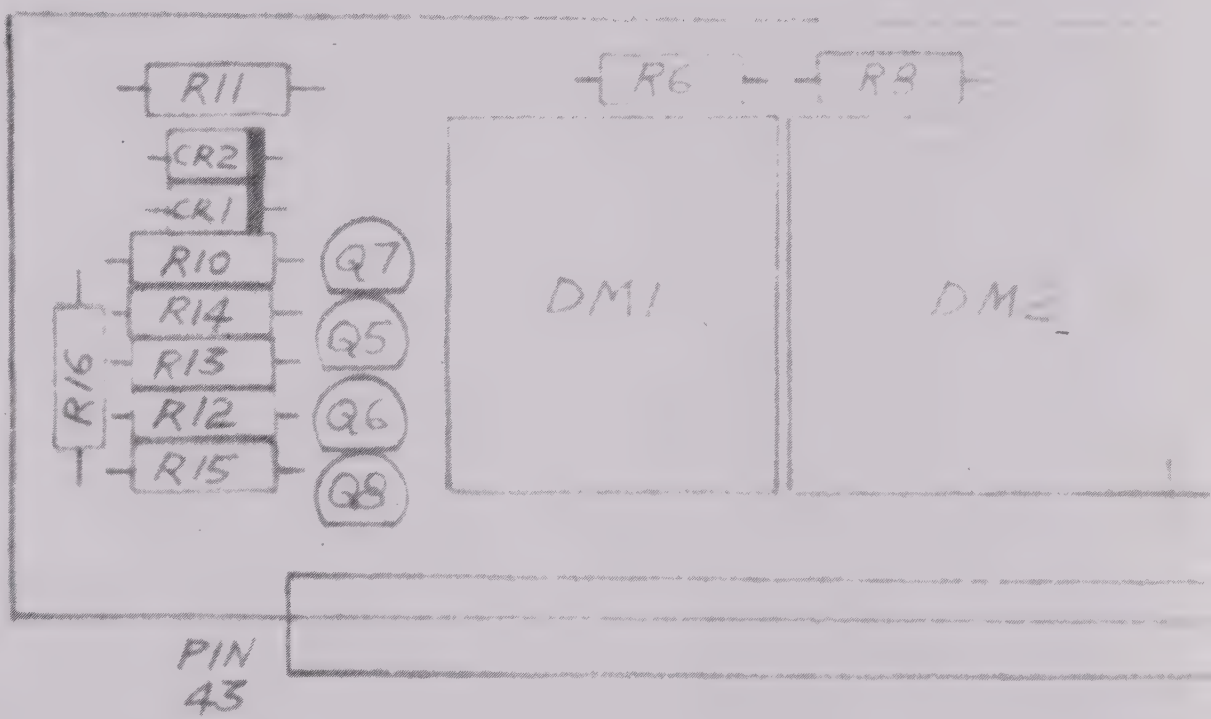
A-D DISPLAY ANALOG SECTION
1045/1041.

DRAWING NUMBER 430004 ISSUE 2 Ø 4

SHEET 2 OF 2

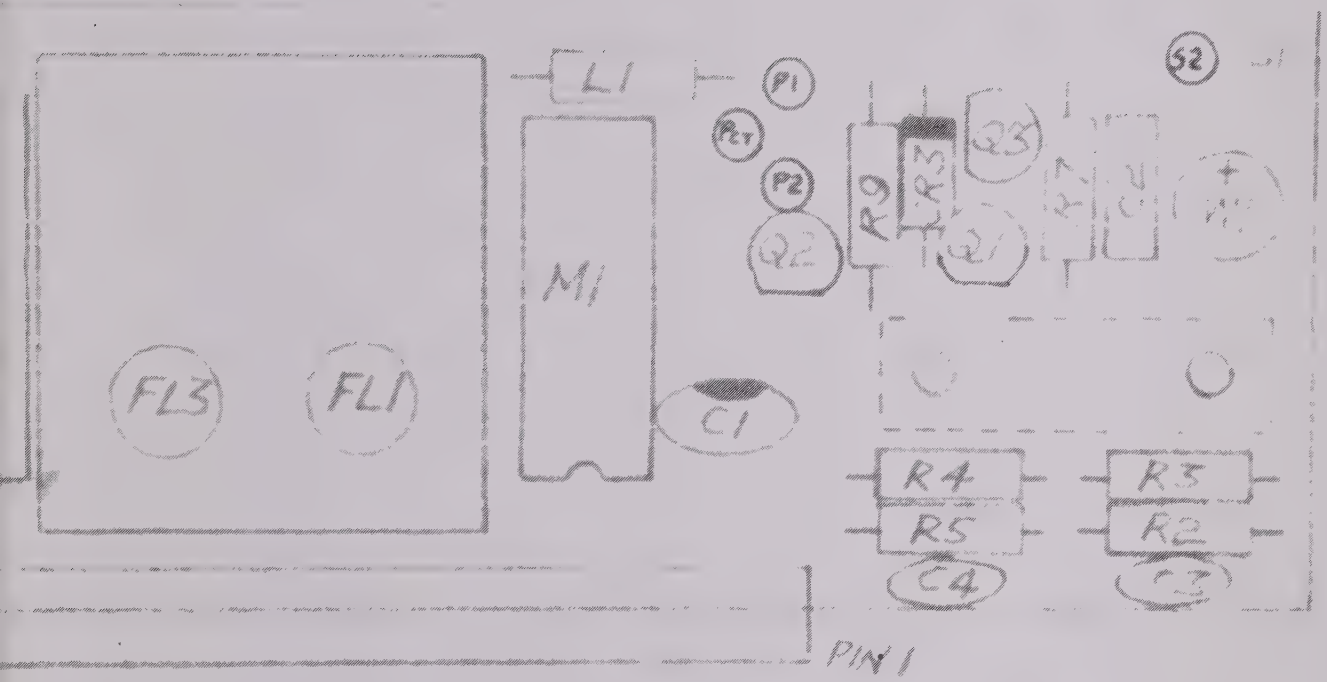
THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH B.S. [illegible]



DRAWN	CHECKED	DIMENSIONS IN MILLIMETRES		MATERIAL
TRACED	APPROVED			
DATE 6/75	DATE	SCALE NOT TO BE SCALED		FINISH

ISS	CHANGES
4	PARTS LIST CHANGES ECO 441 TL 1.4.77



TRANSFORMER WIRING

P_1 GREEN
P_{CT} YELLOW
P_2 ORANGE
S_1 BROWN
S_2 RED

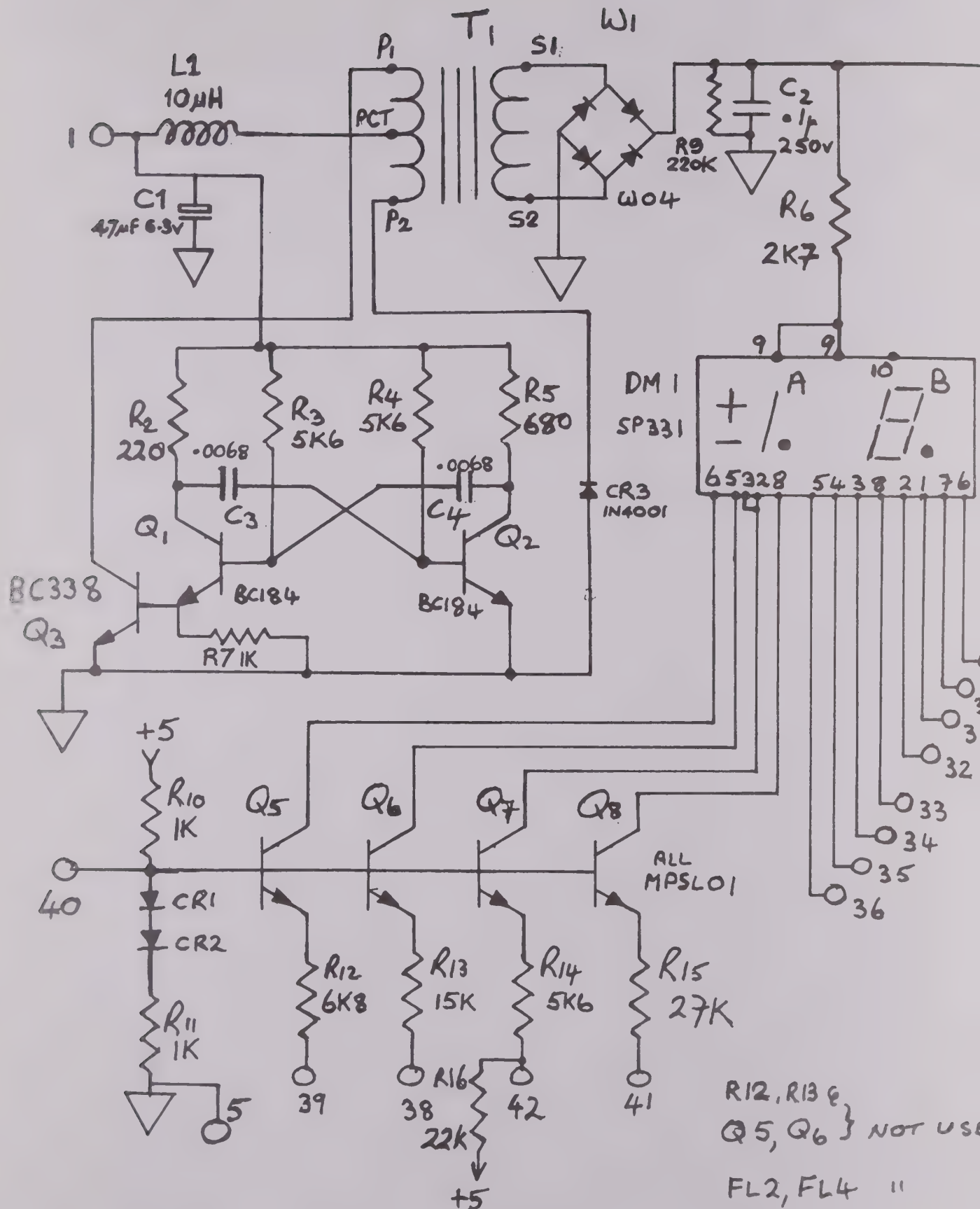
datron ELECTRONICS LTD. NORWICH

DRAWING SIZE A4

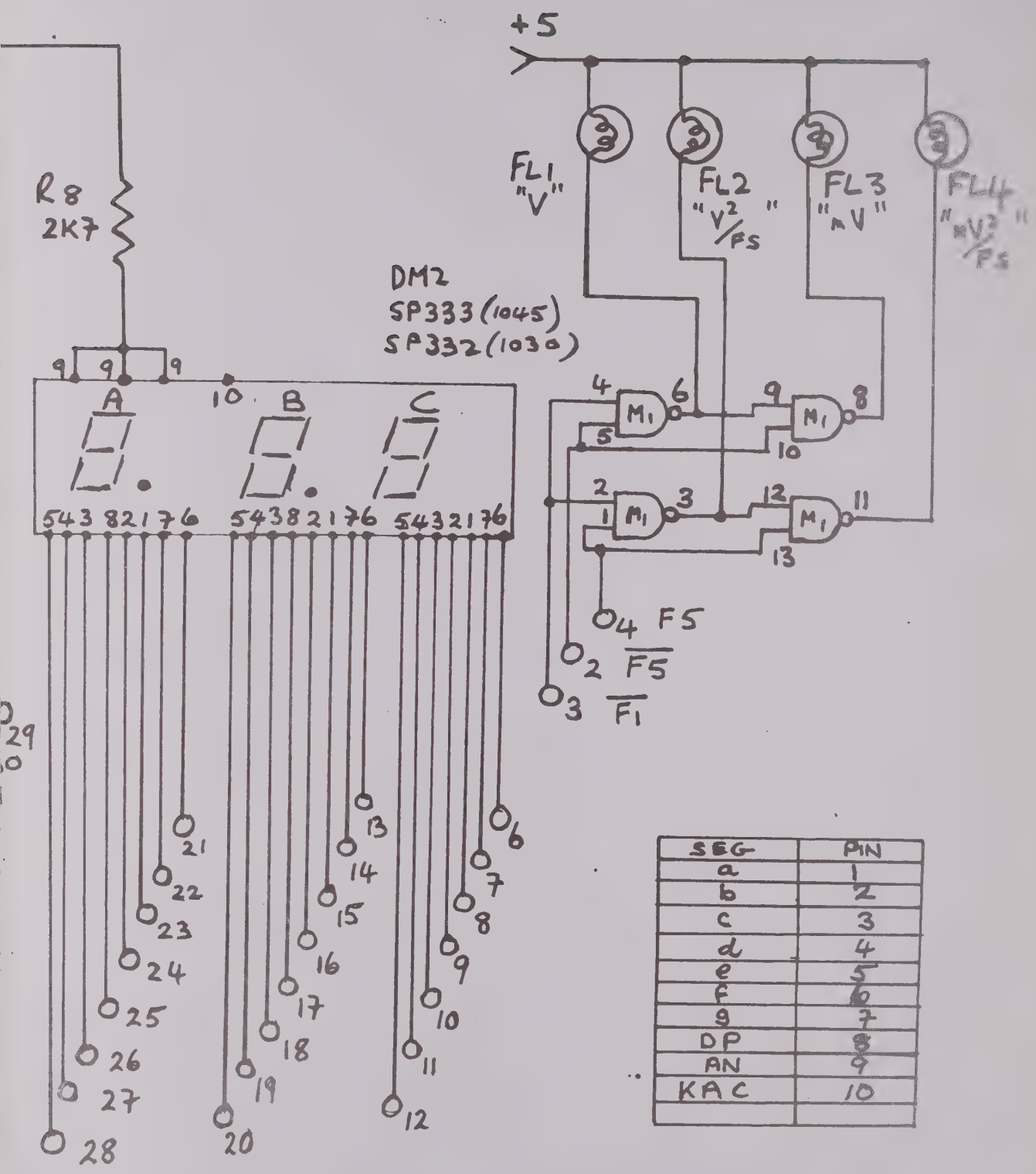
TITLE 1045 SPEEDOMETER DISPLAY

DRAWING No. 400028

SHEET OF 1/3



ISSUE 3 2
ISSUE 4 ECO 4



SEG	PIN
a	1
b	2
c	3
d	4
e	5
f	6
g	7
DP	8
AN	9
KAC	10

ED IN 1030 (400025/29)

" " 1045 (400028)

3-4-75
10 1.4.77

DATE. 23-11-73	datron ELECTRONICS LTD.	
DRAWN BY. JKP	TITLE 1030/1045 DISPLAY SCHEMATIC (SPERRY)	
CHECK		
NEXT DRAWING 400025 / 400 028	DRAWING NUMBER 430006	SHEET 1 OF 1

ADDENDUM AND ERRATA SHEETS INDEX

INSTRUMENT: 1095

SERIAL NO: 02380

COMPONENT PARTS AND SERIAL NOS.	ASSOCIATED UPDATE SHEETS

ERRATA SHEETS:

datron

TO: THE USER

Every effort has been made to ensure that the information supplied with the instrument is accurate and up to date. If, however, you find any errors or have any suggestions for improving this Manual, please return the reply card completed as appropriate.

Full information is available on the complete range of Datron products and we will be pleased to forward these to you on request by return of the reply card completed as appropriate.

Name:

Dept:

Company:

Address

Instrument:

Serial No:

Manual Ref. No.:

Correction / Suggestion:

Please send information on the following products:--

Model 1030	True RMS Digital Voltmeter	☐
Model 1041	4½ digit Multifunction Digital Voltmeter	☐
Model 1045	4½ digit DC Digital Voltmeter	☐
Model 1051	5½ digit Precision Multifunction Digital Voltmeter	☐
Model 1055	5½ digit DC Digital Voltmeter	☐
Model 1057	5½ digit Digital Multimeter.	☐
Model 1059	5½ digit Digital Multimeter.	☐
Data Logging Equipment		☐

MP MASTER
MA23504